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Battelle Technical Review

IN THIS ISSUE : Atmospheric Ions and Human Behavior

VIGNETTE

JOHN M. BLOCHER, JR.

In chemical vapor deposition a compound or its elements are deposited as coatings or in massive form by the chemical reaction of vapors, usually at a heated surface. Long an art with but limited application, the process today is finding acceptance in the preparation of refractory materials and high-purity metals.

"New areas of usefulness for vapor deposition techniques are being revealed," according to John M. Blocher, Jr., "as studies are undertaken of the emergent problems of atomic energy and the space age. Examples are the coating of nuclear fuel particles, the preparation of solid state devices, and the development of protective coatings for space vehicles. Still other applications appear likely. But to make the best use of the phenomenon, we must achieve a better understanding of the fundamentals of the deposition process. For example, we need to know: By what mechanism does deposition occur? How do the atoms or predissociation molecules migrate on the surface to nucleate and form crystals? Answers to these and related questions will open greater areas of usefulness for chemical deposition."

John joined the Battelle staff immediately after completion of his graduate studies. He plunged directly into research on techniques for the preparation of high-purity metals, especially by means of halide reduction or decomposition. Chief among these metals were chromium, niobium, tantalum, titanium, and silicon. Later he undertook the determination of the thermodynamic properties of metal halides, particularly of titanium. In still another area, he has contributed to the development of procedures for the carbide coating of graphite.

In recent years, John's technical interests have broadened. He and his colleagues have proposed a potentially most significant concept—coating nuclear fuel particles to protect them from damage in the reactor while sealing in troublesome radioactive by-products. Currently they are studying the coating of uranium compounds, principally oxides, with various metals, oxides, metal carbides, and pyrolytic carbon by vapor deposition of particles suspended in gas in a fluidized bed. They are also conducting research on the application of refractory coatings and on other specialized coating procedures useful in the high-temperature conditions of space flight. In another area, John's research group is investigating processes for the preparation of high-purity refractory metals.

A graduate of Baldwin Wallace College with a B.S. degree in chemistry, John received his Ph.D. in physical chemistry from Ohio State University. His graduate study was punctuated by work in the field of mass spectrometry at Oak Ridge for the Manhattan Project. John is author or coauthor of more than a score of papers and articles. His studies have also led to seven patents, issued and pending.

John holds technical society memberships in the American Chemical Society, the Electrochemical Society and Sigma Xi. He is currently a divisional editor of the *Journal of the Electrochemical Society*.

John and Phyllis, his wife, who met in college, have a fine family which includes Joann (now in college), John (in high school), Kathy, Mary Sue, and Dick. John's work with the Boy Scouts and his great interest in music—he sings with several groups and directs a children's choir—leaves little time for his favorite sports, swimming and ice skating.

BATTELLE TECHNICAL REVIEW

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INTRINSIC RADIOISOTOPES FOR CHEMICAL PROCESS CONTROL

Inherent in chemical process control is the measurement of physical and chemical properties of the materials in the process. In many cases the nature of these materials (i.e. hot, corrosive, toxic, or chemically complex) makes such measurements difficult to obtain or to interpret. Often, too, instrumentation is costly or not adaptable to plant conditions. Hence, new or improved measurement techniques are needed.

A new technique, now under study at Battelle, promises to provide an answer for some of these problem processes. Through the use of radioisotopes it can provide accurate data on a continuous basis and in a form that can be converted into electrical signals for controlling processes automatically.

Basically, the method involves the addition of intrinsic radiotracers—isotopes of each of the elements to be processed—to a solution or slurry. Thus, when removing cadmium from zinc sulfate electrolyte, as shown here, radioactive cadmium is added to the electrolyte. The level of radioactivity in the liquor, which is never higher than AEC's limit for drinking water, is measured at the start and at the conclusion of the continuing process. Comparison of the two readings shows what proportion of the cadmium has been removed. Spot checks by conventional chemical analysis proved the correctness of the readings. Other experiments have involved removal of iron from mixed nickel cobalt sulfate solutions and manganese from process water.

According to James L. McFarling, shown with the equipment, the use of short half-life radioisotopes practically eliminates radioactivity contamination problems. Also contributing to the study, being conducted for the Atomic Energy Commission's Office of Isotopes Development, are Battelle staff members Peter Gluck, John F. Kircher, and Duane N. Sunderman.

NOTES from BATTELLE

✻ CHINA'S "MARCH ON SCIENCE"

One of the shadowy areas in the world's science picture is Communist China. Yet our knowledge about what is going on there is likely to decrease rather than increase in the near future unless the Chinese policy on the export of publications changes. Since 1960, the receipt of Chinese scientific periodicals by the Library of Congress has been moving toward zero; none, in fact, have been received this year.

In an effort to estimate Communist China's progress, the National Science Foundation sponsored a symposium at last year's annual meeting of the American Association for the Advancement of Science. Specialists in 25 scientific fields, having analyzed masses of available Chinese literature, presented their appraisals. These are soon to be published in the AAAS *Symposium Series*.

Information presented at the symposium included these points:

• China has perhaps fewer than 400 research mathematicians with training equivalent to the doctorate; not more than 1200 at the doctorate level in the natural sciences.

• The country has upped the total of its geological workers to 21,000 as compared with 200 in 1949. As a result, the country is discovering and exploiting its vast mineral deposits. China is now sixth among steel producers and third in production of coal.

• Crop-improvement research has been hindered to some extent because the theories of Michurin rather than those of Mendel and Morgan must be followed.

• Although electric power production has increased by 800 per cent since 1952, 1960 production amounted to only 90 kwh per capita as compared to 4250 kwh in the United States.

How China is faring in its technological manpower problems is discussed in a report by Leo A. Orleans, *Professional Manpower and Education in Communist China*. His analysis, sponsored by the NSF, points out that the quality of present college graduates is usually low and that those who have been trained in the West and in the U.S.S.R. are the core of China's professional manpower. At the same time, the author suggests that educational methods suitable to the country's situation are being employed. The educational base of the masses is being raised, and the number going into professional training is rising about 10 per cent each year.

China's current pool of people with higher education is put at about 625,000 by author Orleans. His partial breakdown: 171,700 in engineering, 134,700 in education, 70,000 in finance and economics. According to present estimates, annual additions to this pool include about 18,000 engineers, 30,000 in education, 5000 in health fields, and 4600 in science.

✻ WATER TRANSPORT OF FERTILIZERS

Through more use of water transportation, the fertilizer industry can enhance its services to the American farmer. This was the conclusion of a Battelle study for the Mississippi Valley Barge Line Company. The purposes of the investigation were to provide a fuller understanding of the organization and operation of the fertilizer industry generally, and to relate this knowledge to the use of water-borne transport facilities.

In a report before the Society of Mining Engineers, during the Annual Meeting of the American Institute of Mining, Metallurgical, and Petroleum Engineers, Odin Wilhelmy, Jr. summarized the conclusions from the study. He pointed out that Florida is, and will probably continue to be, the primary source of fertilizer phosphorus. Moreover, the central portion of the United States is the greatest agricultural consumer of this phosphorus. A major share of both the feed and industrial markets for phosphate products also are in the area.

The investigation showed that a considerable tonnage of phosphate rock and triple superphosphate already is being carried by water and that this movement will likely increase substantially in the future. Growth of this traffic may be stimulated through the following steps:

• Development of an economic procedure and facilities for moving ground phosphate rock by water. Know-how to accomplish this already exists from experience with cement.

• Ground phosphate rock may also be made available by establishing grinding facilities at selected riverside points in market areas. The ground product could then be distributed within an economic radius.

• Establishment of terminal storage facilities at selected points in market areas.

• Development of better and more economic handling and loading methods. Anything done to reduce costs would enhance the use of water transportation.

• Establishment of more joint barge-truck or barge-rail arrangements to facilitate shipments to plants not located on navigable waterways.

* NEW ZEALAND IRON, STEEL STUDY

The technological and economic feasibility of establishing an iron and steel industry in New Zealand is now under study by Battelle. Institute metallurgists are collecting data to aid in determining the steelmaking process best suited to New Zealand's raw materials—especially the country's iron-containing beach sands. As announced by acting-Prime Minister John Ross Marshall, Battelle is working with the government-owned New Zealand Steel Investigating Company on all phases of the project.

Metallurgists have conducted on-the-spot surveys of the situation to obtain the necessary technical and economic information, and they have met with industry and government officials associated with the problems. In the final steps of the study, the metallurgists are joining other Battelle technical and economic specialists in analyzing the information and preparing recommendations.

The studies are being spearheaded by H. W. Lownie, Jr., N. H. Keyser, and Robert E. Presnell.

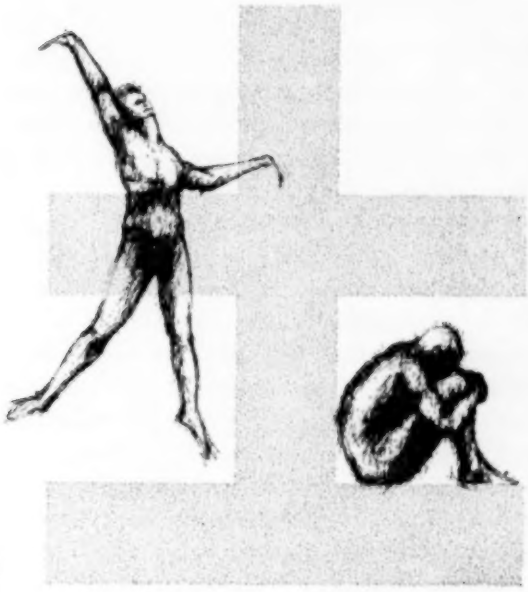
THE GILLETT MEMORIAL LECTURE, sponsored annually by the American Society for Testing Materials and Battelle, will be presented by Augustus B. Kinzel at the 64th Annual Meeting of ASTM in Atlantic City. The lecture commemorates Horace W. Gillett, outstanding metallurgist and Battelle's first director.

Dr. Kinzel, vice president, Research, Union Carbide Corporation, will speak on "Specifications?!" on the afternoon of June 27. One of the country's leading metallurgists, he will discuss the structure and content of specifications in relation to their objectives, the need for flexibility and judgment as a substitute for ignorance, and the relation of tests and testing to specifications, together with the effect of the nature of the test on the nature of the specification.

Dr. Kinzel pioneered in the theory of stainless steel and applications of the structural low-alloy steels and new ferro-alloys. He spearheaded, among other developments, the research leading to Union Carbide's process for making titanium metal.

OIL BURNER STUDIES to develop new information on components for small burners is under way at Battelle. Edgar S. Cheany and his colleagues in the industrial products division are conducting research on methods of improving air compressors and fuel pumps. Robert E. DeMuth and members of the electrical engineering division are seeking more suitable ignition systems. This research is part of a special program sponsored by the American Petroleum Institute at five research centers. All findings will be used by the API to assist manufacturers in the production of improved oil-burning equipment.

BATTELLE STAFF MEMBERS named recently to technical posts include: *Francis W. Boulger*—member, Project Advisory Committee (compositions for heavy section ship plate), National Academy of Sciences-National Research Council; *Walter K. Boyd*—member, Corrosion Control Advisory Team - Air Force/Industry, Headquarters, Brooklyn Air Force Base, Alabama; *Frank C. Croxton*—chairman, Subcommittee on Chemical Engineering Fields in Particular Need of More Research *and* member, Ad Hoc Committee Responsible for Research Committee Forum, American Institute of Chemical Engineers; *J. Harry Jackson*—member, Committee on Engineering Management, Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers; *Robert I. Jaffee*—member, Technical Committee on Alloy Phases, Institute of Metals Division, Metallurgical Society, AIME; *Loran S. O'Bannon*—chairman, Enamel Division, American Ceramic Society; *William T. Reid*—member, Committee E-1 on Methods of Testing, American Society for Testing Materials; *F. Joseph Reid*—chairman, Task Group Subcommittee VI, Mobility Study Group, ASTM; *Perry J. Rieppel*—chairman, Joining Committee, Institute of Metals Division, Metallurgical Society, AIME; *Ward F. Simmons*—chairman and *Curtis M. Jackson*—member, Subcommittee on Special Purpose Alloys, Society of Automotive Engineers; *Carl F. Speich*—member, Industrial Environment Committee, American Society of Heating, Refrigeration, and Air Conditioning Engineers.



by Richard A. Duffee *and* Howard G. Schutz

Atmospheric Ions and Human Behavior

Atmospheric ions are known to affect human behavior. Scientists are seeking more precise information about those effects, both beneficial and harmful, and the physiological mechanisms by which they occur.

With the advent of the nuclear-powered submarine capable of long periods of submergence and of manned space flight, interest in the effect of environmental conditions on human behavior has been stimulated. Atmospheric conditions, which are normally considered to have insignificant effects on performance, or, at most, are regarded as laboratory curiosities, may become of paramount importance in the sealed capsule environment. For example, prolonged exposure to low levels of atmospheric contaminants may produce serious physiological effects, with a concomitant adverse effect on human performance.

Although the electrical properties of the atmosphere have long been blamed for the adverse effect of winds, such as the foehn, chinook, and sirocco, only in the past 30 years have the physiological and behavioral effects of air ions been demonstrated experimentally. The astronaut and submariner may be exposed to ion concentrations considerably higher than normal, and the effects of this increased ion concentration may be enhanced by other environmental factors such as acceleration stress. In addition, in the past decade, nuclear testing and the increasing use of high-voltage electrical equipment has tended to raise the amount of ions in the atmosphere of our living and working spaces. Thus, the control of air ions may prove to be important in maintaining an optimal environment, not only in space capsules, but also in our homes and business establishments.

While most of the reported studies have been concerned with the physiological or therapeutic effects of ions, our purpose here is to present the reported behavioral effects of ions, to discuss problems associated with increasing ion effects, to consider the postulated mechanisms by which ions may produce their effects, and to indicate the types of experimental programs that should be initiated.

Ions—Their Generation and Measurement

What is meant by atmospheric ions? These are positive or negative electrically charged particles or molecules of gas. In the lower atmosphere, ions are produced principally by radioactive materials in the earth's surface or in the air, and by cosmic radiation. Ions vary considerably both in size and in concentration. They are arbitrarily grouped into three size ranges, small, intermediate, and large, measured in terms of mobility, i.e., the distance an ion moves per second in a uniform field of one volt per centimeter. Small ions are defined as those which have mobility of approximately one to two centimeters per second and are probably gaseous molecules. The intermediate ions—possibly free radicals on small molecules—are those with mobilities ranging between 0.01 to 1 centimeter per second. Large or Langevin ions—dust-particle condensation nuclei—are those which move more slowly than 0.01 centimeter per second.

Ion Generation

Normally, ions in air vary from approximately 500 to 2000 ion pairs per cc with a slight preponderance of positive ions. This variation results not only from fluctuations of the primary sources but also from other naturally occurring sources, such as falling snow, water spray, and combustion. Further, man-made sources of ions including nuclear tests, combustion processes, electrical equipment, and high-voltage discharge produce considerable quantities of atmospheric ions in restricted areas. There are many methods of producing and controlling ionization for experimental purposes. Included among these would be thermionic sources such as hot wires, X-rays, high-voltage discharges, radioisotopes (e.g., tritium or polonium) and ultraviolet photoionization.

High-voltage discharge may produce ozone or nitrogen oxides in addition to generating ions. Also, a thermionic source may produce thermal effects. Consequently, for experimental purposes, the most popular types of artificial ion sources within the past few years have been radioisotopes.

Richard Duffee's current research interests include the study of methods for controlling and measuring air pollutants, the development of controlled atmospheres for human beings, and the investigation of the effects of atmospheric ionization on human performance. His research activities at Battelle have included studies in air-pollution meteorology, sampling and analysis of air pollutants, microclimatology, methods for objective measurement of odors, and techniques for evaluating and improving industrial plant atmospheres. Earlier, as a meteorologist in the U.S. Air Force, he pursued studies in bioclimatology—more particularly the physiological effects of the physical environment on man.

Howard Schutz's main research interest lies in the area of overlap between the psychological and physiological aspects of human life. The study of the psychological effects of chemicals and atmospheric factors upon man represents one phase of his current activities. Among his studies at Battelle have been investigations of basic mechanisms of olfaction and of the sensory evaluation of foods. Schutz previously had conducted research in the areas of taste, odor, appetite, and food preferences for the Quartermaster Food and Container Institute.

Ion Measurement

Ion concentration can be measured either by collecting the ions on a condenser or by measuring the space charge potential. A condensing ion-measurement system provides a means of directly determining the ion density for either polarity, but is limited to measuring ions of a limited range of mobility. The space charge ion-measurement technique yields a measurement of net ion density rather than the ion concentration or ion current.

Studies on Behavioral Effects

As stated previously, the concern of this paper is not with the therapeutic effects of ions but rather with their possible behavioral effects on healthy people. However, it is of some interest to note that the consensus of the results of experiments concerned with therapeutic effects of ions is that positive ions have a deleterious effect, whereas negative ions have a normalizing effect. Negative ions have been reported to relieve symptoms of patients suffering from rheumatism, gout, arthritis, asthma, burns, high blood pressure, and many allergy-induced diseases. In many studies, a sense of euphoria or well-being was reported as a side effect of negative ions, whereas positive ions produced feelings of nausea, fatigue, dizziness, and headaches. Those studies, however, that have been directly concerned with the behavioral effects of ions have been limited and, in addition, have not produced definite results.

Subjective Responses

Studies pertaining to the effects of ions on the subjective feelings of comfort have indicated that the effect of positive ionization is unpleasant. F. McGurk reported that the body comfort of 10 college males was adversely affected by positive ionization at the 0.01 significance level. When the air was negatively ionized, there was a marked increase in the number of comfortable or pleasant feeling reports, although the number of unpleasant reports also remained high. C. Yaglou, A. Brandt, and L. Benjamin reported that negative ionization tended to produce a cooling effect on the body, and it was also stated that the subjects could perceive when the air was ionized. They further reported that the most frequent sensation was a feeling of relaxation and sleepiness noted a few minutes after turning on the ionizer. T. Winsor and J. Beckett found that a 20-minute exposure to a concentration of 32,000 positive ions per cc produced headache, nasal obstruction, husky voice, sore throat, itching nose, or

dizziness in 16 subjects. These symptoms, in general, appeared two or three minutes after the start of ionization and lasted as long as the ions were present. Negative ions resulted in four subjects out of 13 tested reporting symptoms of dry nose, tingling nose, smarting eyes, and congested throat, generally less severe and of shorter duration than reported with positive ionization.

Performance

An extensive series of studies on the effects of ions on human performance is being conducted by Professor Max Knoll in Munich. These studies are primarily concerned with the effect of artificial ionization of the atmosphere on human push-button reaction time. In his first set of experiments, an effect of ions on reaction time was found which was statistically significant. However, the effect was not reproducible in that the magnitude or the change in reaction time and the direction of the change differed for different experiments and subjects. These results were not found to be due to experimental error; rather they were attributable to some other source, such as meteorological or chemical factors. Knoll further pointed out that both negative and positive ions could produce the same effect and concluded that the ion polarity was not the important factor in the mode of operation of ions.

Further studies by Knoll's group yielded the following results. First, ions must be breathed in through the mouth to produce an effect upon reaction time. When ions were breathed in through the nose or directed against the skin, no effect was produced. Knoll attributed this to the fact that ions must go through many small passages in passing through the nose, and thus they come in close proximity with many conducting surfaces. Second, different levels of ionization were shown to have a clearly different effect on the reaction time. It was found that in the range of 10^6 to 10^4 ions per cc, a small concentration of ions had a greater tendency to reduce the reaction time, while a larger concentration tended to increase the reaction time. They further found that in practically no case did a relatively large ion current decrease the reaction time, while in the same experiment, some small ion currents did increase the reaction time. Dr. Knoll's group, in this latter study, also investigated the possibility of evolving ozone from the ion generators. Within the limits of the apparatus used, no trace of ozone was found. The conclusion was drawn that the ions, rather than ozone, were responsible for the effects noted.

An additional reaction-time experiment was conducted by Speicher, as reported by A. H. Frey, using a foot pedal and a red light. After five to ten practice trials, subjects performed in blocks of 25 trials, two blocks per day. Each block was either a control series, a negative ionization series, or a positive ionization series. He found that positive ionization increased the reaction time of some people, while negative ionization reduced the reaction time of some people. This difference in reaction time did not hold in comparing groups. In a study by McGurk, previously cited, ten college males were subjected to a total of five hours of a work test that involved the subject placing five differently colored iron washers on a standard 5/16-inch bolt, and then fastening the nut securely. He reports no statistically significant mean-score-difference among the three ion conditions, positive, negative, or control. He states, however, that the distribution of scores was markedly bimodal for both the negative and no-ionization sessions while the positive-ionization sessions were trimodal.

In the three studies just referred to, the differences in the mean scores of positive, negative, and control conditions were negligible. Yet significant changes were reported for individual subjects during ionized conditions, for both polarities and in both directions. Thus, the fact of individual differences in susceptibility to ions is apparently of paramount importance in both the understanding of the mechanism of operation of ions and in the potential application of ion-controlled atmospheres. M. A. Vytchikova and A. A. Minkh found that after 25 days of inhaling negative ions for a fifteen-minute period daily, athletes maintained a standard grip on a dynamometer 46 per cent longer than control subjects. After nine days of negative ionization, endurance as measured on a treadmill increased 55.9 per cent.

Physics, Engineering, and Chemistry Corporation, Colorado, has conducted a study for the Wright Air Development Division on the effects of ions on human performance. In this study, three performance tests were used: one was a complex mental test, the second a perceptual task, while the third test was essentially an attitude measurement questionnaire. Groups participated in various activities, such as discussion, problem solving, mental mazes, and a coding test. The chief point of interest was the between-test use of an adjectival check list to describe subjective feelings. Results of the report on the complex mental test indicated no effect. No effect was reported on the perceptual task. There were also no significant results on the attitude test, but it did show a trend opposite to the expected one in that positive ions tended to result in improved performance of the tasks. At the present time, the results of tests conducted by PEC during the past year, emphasizing more levels of

ionization and greater numbers of subjects, are not available. But a personal communication indicated that no significant results were found with either positive or negative ions.

Influences on Measurement of Behavioral Effect of Ions

As might be deduced from the previous discussion, many factors could possibly interfere with measuring changes in behavior due to ions. It would be relevant, therefore, to consider some of these factors and their possible effects in more detail. Some of the environmental factors which might produce confounding effects are temperature, humidity, light level, noise level, or the presence of physiologically active gases.

Environmental Factors

It is common knowledge that temperature and humidity extremes can produce behavioral effects or performance changes in individuals. Consequently, if these are not controlled during study, their effects could possibly mask any behavioral effects attributable directly to ions. McGurk noted in his study that the working conditions in the test room were very uncomfortable, and that the relative humidity was often 100 per cent, while the temperature was generally about 85 F. Further, studies conducted by R. Shiratori have indicated that there is an inverse correlation between the combined effects of temperature and humidity in excess of about 80 per cent and the concentration of ions in the atmosphere.

Extreme brightness or sudden noises would be expected to affect performance and help to mask the effects of ions. Consequently, a constant level of both light and noise should be maintained for any study of the behavioral effects of ions.

Psychophysical Characteristics of Subjects

Another set of factors that could affect measurement of behavioral changes due to ions may be grouped as psychophysical characteristics of subjects. These would include the subject's previous exposure to ions, physical condition, age, sex, and degree and type of stress prior to or during the experiment. Little is known about the effects of previous ion exposure of long duration in studies using artificially produced ions. This may be an important factor which could account for some of the variability found within one experiment or among different experimenters. It may be that the change in ion levels, rather than the actual type of ionization, is the important parameter in determining the effects of ions on behavior.

It is known that performance varies, both with the age and sex of subjects, for different tests. In studies of the effects of ions in which only a few subjects are used, large differences in the ages of the subjects or the use of only one sex could produce spurious results.

The physical condition of the subject and the previous degree or type of stress that he has undergone could be important variables in determining behavioral effects of ions, since many authors seem to feel ions tend to have a normalizing effect on subjects.

Another important experimental variable is the type of performance or behavior that is measured in an ion experiment. If the variable being measured is a subjective one, such as comfort or feelings of well-being, it is open to a wide range of individual differences and attitudes that would certainly increase the variability in the results of such a study. For the objective, performance-type measurements there is the factor of the difficulty of the tasks. It may be that the task is so simple that, although there may be real changes due to the type of ions, it is not sensitive enough to pick up these differences. Another consideration is that the kinds of interferences produced by ions might only operate on a more complex mental task, rather than on motor tasks.

Another factor to consider is the primary-sense modality involved in the task. For example, the visual sense may be more impaired than the auditory or tactile sense. Certainly, knowledge concerning this variable is extremely important in the future possible application of ions in controlled atmospheres. The types of performance that have been measured to date in experiments on effects of ions on behavior have only touched on a few of the many types of performance variables which could be measured.

Theories for the Operation of Ions on Man

The mechanisms that have been hypothesized for the operation of ions on human behavior or physiology will now be considered. All postulated theories involve one or more of three basic mechanisms: electrical, chemical, and hormonal. They are presented separately, but there is no reason to doubt that any combination of the three might explain reported ion effects.

Electrical

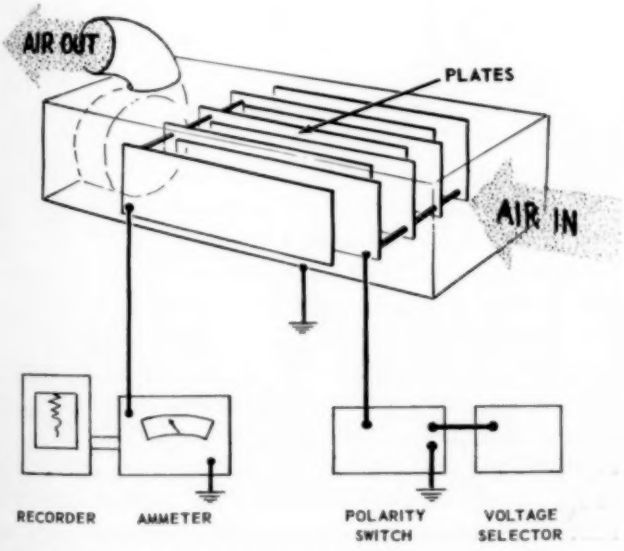
There are several varieties of electrical influence theories. One is that the biological effect of ions occurs at the cellular level, because of a change in conductivity of the cell structure or the electric charge of the cell membrane. D. Dorno presented a hypothesis that involves the effects of ions directly upon the autonomic nervous system through stimulation of

An improved device for measuring ion density. Cylindrical plates within the vertical cylinder (center) permit more exact measurement of ion density.

sensory skin nerve endings, thus resulting in an intracellular ion exchange. L. Tschijewski postulates that electricity is metabolized by way of the pulmonary endothelium and the red blood corpuscles. Knoll's work concerning the effect of ions on human reaction time, which showed that ions must be breathed in through the mouth to affect reaction time, would seem to invalidate the theory concerning the stimulation of sensory skin nerve endings. Tschijewski's theory of organic metabolism of electricity could still be tenable; however, it is difficult to explain how an electrical theory can account for the fact that both positive and negative ions produce similar effects in different individuals.

Chemical

The chemical mechanisms that have been suggested fall into two general categories. The first concerns a change in atmospheric composition due to the presence of ions or a change in the activity of atmospheric gases. The second group postulates that the ion generator itself may produce gases which then



Basic elements of a standard ion density measuring device.

may have an anesthetic or other physiological effect.

An example of the first group is that positive ions effect a change in the atmospheric oxygen, transforming it into a form unsuitable for oxidative processes, thereby resulting in a harmful effect. A. Krueger and R. Smith, however, reason that negatively ionized oxygen has the distinctive ability to react more rapidly with certain ion porphyrin compounds, and this in turn is responsible for many of the physiological effects of ions. They cite the effects of decrease in respiratory rate, increase in the rate of tracheal ciliary beating, and increase in mucous flow during negative ionization. They also state that negative ions apparently act directly on cytochrome oxidase, or form a radical upon contact with water which acts directly on cytochrome oxidase.

Frey reports that Edgerly postulated that the biological effects produced by ions result in the initial ionization of water in tissues and the subsequent dissociation into atomic hydrogen and a free hydroxyl radical. These products, or the secondary products, reacting with protoplasmic constituents result in all the biological effects of ionizing radiation. Edgerly's hypothesis would seem to be refuted on the basis of work performed by Krueger and Smith, using ionized nitrogen, oxygen, and carbon dioxide. In this work neither positively ionized nor negatively ionized nitrogen had any effect whatsoever on tracheal ciliary rate.

The hypothesis regarding the effect of the change in atmospheric oxygen due to positive ions would also seem to be refuted by Krueger and Smith's work when positively ionized oxygen had no effect on tracheal ciliary rate. Of considerable interest is a chemical mechanism suggested by the work of J. Worden which showed that the pH and carbon dioxide combining power of the blood is altered under different air ionization. Thus, the oxygen-carrying capacity of the blood could be the fundamental mechanism for the behavioral action of ions. This hypothesis could account for the improved endurance in athletes reported by Vytchikova and Minkh.

Hormonal

An interesting mechanism for the biological effects of ions has been hypothesized by Frey. The basis of his hypothesis is that the operation of ions on the human may be due to an influence on the adrenal cortex, and subsequent change in the production of corticoids. Specifically, Frey stated that negative ions stimulate the secretion of the gluco-corticoids, and the positive ions either stimulate the secretion of the mineralocorticoids or inhibit the gluco-corticoid secretion.

He presented three arguments to support the hypothesis. First, he states that atmospheric ions do

affect the adrenal cortex, and thereby the secretion of the corticoids. Frey quoted several studies that show that the adrenal gland, when exposed to positive ion concentrations of the order of 2000 ions per cc, undergoes histological changes. Furthermore, animals living in ionized atmospheres, both positive and negative, show changes in weight, cholesterol, and ascorbic acid content of the adrenal glands. Second, he says that the secretion of the different corticoids can vary independently of each other, i.e., that stimulation of the adrenal cortex to produce more gluco-corticoids will not necessarily produce mineralo-corticoids. Consequently the ratio of the gluco-corticoids to the mineralo-corticoids may vary. His final argument is based on the similarity between the effects of positive and negative ions and the action of the gluco-corticoids and mineralo-corticoids. Based on this hypothesis, Frey inferred that the negative ions would be effective only when the organism or subject is under some stress, since gluco-corticoids operate in this manner. He suggested that variability in experimental results may be due to this factor.

This theory seems to the authors to be by far one of the most promising that has been put forward to date. However, it should be noted that Frey does not give an explanation as to how ions affect the adrenal cortex to cause a change in hormonal secretion. Perhaps the solution lies in a mechanism, such as suggested by Tschijewski, that ions are metabolized through the pulmonary endothelium. If so, ions would enter the blood stream where they could affect the adrenal gland directly or through stimulation of the autonomic nervous system.

With the hormonal hypothesis, a reasonable explanation may be given for results such as found by Knoll on the relation between positive and negative ions and human push-button reaction time. Knoll, it will be recalled, found that both negative and positive ions produced an increase and a decrease in reaction time in different individuals. The beneficial or harmful effects of positive or negative ionization could have been determined in part by the levels of the gluco- and mineralo-corticoids of his experimental subjects.

The hormone hypothesis is also attractive in that it offers a good opportunity for experimental verification. Many experiments suggest themselves in which either animals or humans could be tested under positive and negative ionization, under stress and nonstress conditions, and under the influence of injected corticoids. It may be possible through the use of some simple physiological measurement to determine those people who would be affected in a detrimental fashion by negative ions, i.e., those people under stress, who are producing sufficient gluco-corticoids so that negative ions would cause only an excessive amount of gluco-corticoids, and thus result in poor performance. It might even be possible to predict the performance of such people on the basis of psychological tests which measure degree of emotionality or other relevant personality variables which might be related to the level of stress reaction. It may be that those people who are able to manage and cope with stresses very effectively are those who have sufficient gluco-corticoids and are, thus, those for whom negative ionization would be of no value. Whereas, those who are unable to manage or cope with stresses effectively would be benefited by negative ionization.

In animal studies it would be possible to inject gluco- or mineralo-corticoids and examine their effects in relationship to the use of negative or positive ionization. Here an excess of these hormones could be artificially produced, and the effects on the animals of the addition of the variable of negative or positive ionization could be examined. In addition, animal studies allow the long-term use of particular types of ions and also preconditioning of the animal under particular ion-atmospheric conditions.

Conclusions

In summary, there is no question that atmospheric ions can have an effect on human behavior, but the amount of this effect and the ion polarity responsible for the change is not presently predictable. Since, as stated in the introduction, the effect of atmospheric ions might be quite important in such confined, long-term conditions as exist in nuclear submarines and space ships, it is important that we find out just what conditions are necessary for the effects of atmospheric ions to occur. To do this, experiments must be conducted under highly controlled conditions, for both animals and humans. The use of humans would be desirable, but it is recognized that, for some of the extreme conditions and for techniques which involve conditions which might be harmful to the human, animals would be necessary.

Factors such as pre-ion condition, length of exposure to ions, type and degree of stress, and the kind of performance being measured will be among the variables which will have to be investigated in order to obtain a clear picture of the effects of atmospheric ions. Although this area of research is fraught with experimental difficulties, the next few years will surely bring a much clearer understanding of the behavioral effects of atmospheric ions and of how they may be used advantageously.

Oxidation-Resistant Coatings for Refractory Metals

Oxidation quickly destroys refractory metals and their alloys at high tempertures where the strength of these materials is needed. Refractory coatings, the only current means of preventing such oxidation, and refractory coating problems are discussed here.

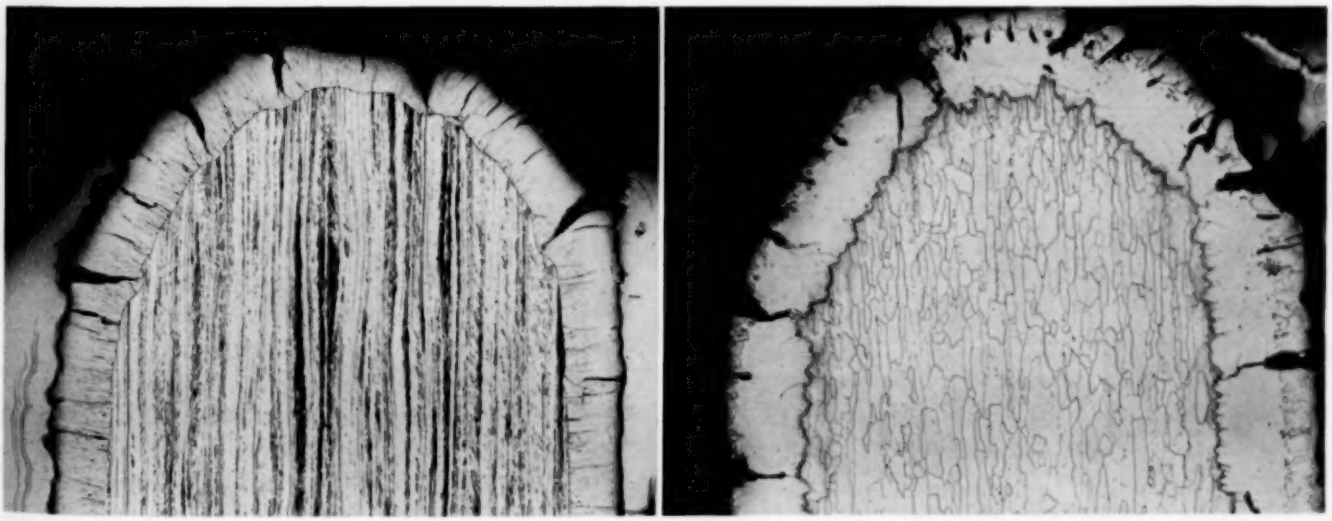
by C. A. KRIER

THE GROUP OF MATERIALS called the refractory metals generally includes those metals with melting points equal to or higher than that of chromium, which is 3405 F. On this basis, there are a dozen refractory metals with widely varying properties and availability. These metals are the subject of intensive research and development at the present time because their high-temperature strength properties are required in nuclear energy applications, advanced aircraft, and space vehicles. The table on page 12 lists the refractory metals in order of decreasing melting point, together with data on their crystal structure and some of their physical properties.

Why the refractory metals must be used for structural applications involving temperatures above about 1800 F is shown by the figure on page 13. Although the nickel-cobalt-base superalloys have met technological demands very well up to 1800 F, they cannot at present satisfy the higher temperature requirements of nuclear power generation, atmosphere glide re-entry, rockets, turbojets, and high-Mach ramjets. Also, there appears to be little hope of extending the usefulness of the superalloys into the higher temperature range.

Most uses of the refractory metals require service in an oxidizing atmosphere. Rhodium, chromium and hafnium are the only refractory metals that are relatively oxidation resistant. These metals, particularly chromium, have from time to time shown some promise as protective coatings under special circumstances; however, they are far from being cure-alls for protection problems. The other refractory metals suffer drastic oxidation in the temperature ranges where their strength properties are required, as shown in the graph on page 15.

For various reasons, the refractory metals of most importance in current and anticipated technology are tungsten, tantalum, molybdenum, and columbium. Except for rhenium and osmium, these four metals as a group are the least oxidation resistant of the refractory metals. Design engineers generally would gladly trade



Photomicrographs showing problems associated with a typical coating-refractory system. (Left) As prepared, the system shows cracks characteristic of brittleness and thermal expansion mismatch. (Right) The same area after 22 hours exposure at 2700 F exhibits radical composition changes resulting from coating–substrate interdiffusion at high temperature.

PROPERTIES OF REFRACTORY METALS

Metals	Melting Point C and *F*	Boiling Point C and *F*	Crystal Structure[a]	Density g/cm³	Thermal Conductivity cal/cm²/cm/C/sec	Electrical Resistivity, microhm-cm at 20 C	Heat Capacity, cal/g/C at 20 C	Coefficient of Linear Expansion, 10-6/C, near 20 C
Tungsten	3410 *(6170)*	6700 *(12,000)*	BCC	19.3	0.48	5.5	0.032	4.5
Rhenium	3180 *(5755)*	5630 *(10,100)*	HCP	21.0	0.17	19.3	0.033	6.7
Osmium	3000 *(5430)*	5500 *(9,900)*	HCP	22.5	..	9.5	0.031	6.6
Tantalum	2996 *(5425)*	6100 *(11,000)*	BCC	16.6	0.13	13.5	0.033	6.6
Molybdenum	2610 *(4730)*	4800 *(8,600)*	BCC	10.2	0.35	5.21	0.061	5.4
Iridium	2442 *(4428)*	5300 *(9,500)*	FCC	22.4	0.35	5.3	0.032	6.5
Columbium	2415 *(4380)*	3300 *(5,900)*	BCC	8.56	0.125	14.8	0.065	7.1
Ruthenium	2250 *(4080)*	4900 *(8,800)*	HCP	12.2	..	9.5	0.058	9.6
Hafnium	1975 *(3585)*	5400 *(9,700)*	HCP[b]	13.36	0.053	30.0	0.035	6.0
Rhodium	1960 *(3560)*	4500 *(8,100)*	FCC	12.4	0.36	4.7	0.059	8.5
Vanadium	1900 *(3450)*	3350 *(6,060)*	BCC	6.11	0.074	24.8	0.119	9.7
Chromium	1875 *(3405)*	2469 *(4,476)*	BCC	7.20	0.16	12.8	0.107	6.2

(a) BCC designates body-centered cubic; HCP designates hexagonal close packed; FCC designates face-centered cubic.
(b) HCP lattice transforms to BCC at 1310 C.

all twelve of the refractory metals for one with the strength of tungsten, ductility of tantalum, oxidation resistance of rhodium, and the abundance of chromium!

The most desirable way of overcoming the disadvantages of poor oxidation resistance is through alloying. Considerable improvement in their oxidation resistance—notably of columbium and tantalum—has been made by this technique; those alloys which have satisfactory oxidation resistance, however, do not have satisfactory mechanical and metallurgical properties. Therefore, it is generally conceded that coatings are required to protect structural refractory metal alloys from oxidation.

Background of Coatings Research

The problem of protecting the refractory metals from oxidation is but one of the vast array of problems under the common heading of corrosion, which annually costs the economy about $6 billion.

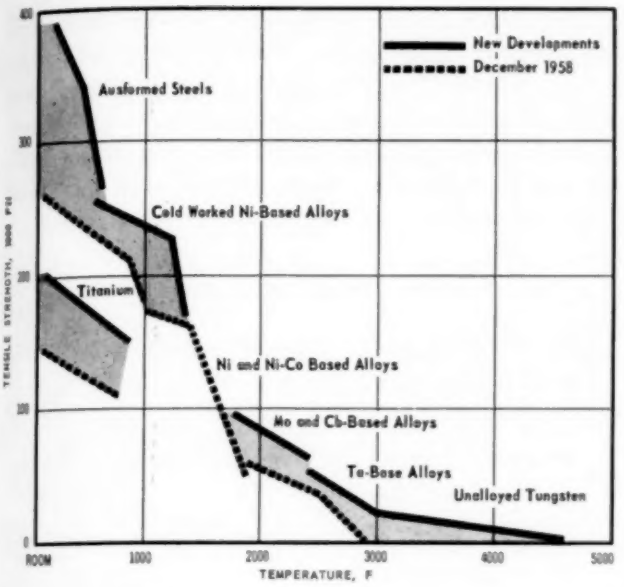
No pure metal and no pure alloy is thermodynamically stable in air even at ambient temperature, and as the temperature increases their stability decreases. Most of the metals that are termed oxidation resistant have this quality because of a thin protective oxide coating. This coating forms rapidly on the surface and prevents or greatly retards the rate of further contact between the air and the metals. The principal refractory metals do not form their own protective oxide coatings, hence the problem.

About 1900, the electrical equipment companies became concerned with the oxidation problem for tungsten and molybdenum. They provided most of the research effort in trying to apply protective coatings until it became very obvious in the late 1940's that the problem was of major interest in the defense effort. Many of the coating systems studied during the early years of research on protective coatings are still under development: these include noble metals, nickel, chromium, stainless alloys, aluminized and chromized coatings, silicides, alumina, magnesia, and beryllia. The study is continuing, not because of failure to solve some of the original problems, but rather because the environmental conditions and applications have become increasingly severe with time.

Research effort on coatings for columbium and tantalum did not get under way until the late 1950's when these metals became available and their potential as structural materials was recognized.

Today there is a flurry of activity to solve the many problems encountered in providing protective coat-

Dr. Krier has conducted extensive research on protective coatings for refractory metals and is surveying the field in preparation for a comprehensive state-of-the-art report. The high-temperature oxidation behavior of the refractory platinum-group metals and the development of alloys resistant to attack by oxidation products from high-energy fuels have engaged his attention. Krier has also participated in extractive metallurgy studies of many metals from titanium through tungsten in the periodic table. During graduate work at the University of Pittsburgh, he investigated thermodynamic properties of pure metals and intermetallic phases from the cryogenic region to above room temperature.



How strength levels of typical high-temperature structural alloys have risen since 1958. Shaded areas indicate the extent of the increase as measured by tensile strength.

ings for tungsten, tantalum, molybdenum, and columbium. Good structural alloys of these metals have been and are being produced by a very substantial research effort. Nevertheless, these alloys will not assume a prominent role in technology until they can be reliably safeguarded from hostile oxidizing environments by protective coatings.

Philosophy of Coatings Research and Development

The general problem of protecting the refractory metals from oxidation can be broken down into two major subproblems:

- Finding coating materials which have the required oxidation resistance in their own right and which have the required chemical, physical, and metallurgical properties to be compatible with the substrate alloy to be protected.
- Developing a process for putting the coating material and the alloy substrate together into a workable system which will reliably accomplish a specified mission.

The history of coatings research and development has shown that neither of these problems is simple and easily solved. Yet we have good reason to believe that the problems are solvable.

There is not now and probably never will be a universal coating that will provide oxidation resistance to all structural refractory metal alloys in all of the contemplated applications. Hence, early in any research program, it is important to specify the exact alloy substrate to be protected and the geometry of the hardware to be used. It is likewise very important to specify the exact environment in which protection must be achieved. These specifications set limits or boundaries to the over-all problem and allow the research worker to classify materials roughly as potentially promising or not promising as coatings. The specifications also permit the establishment of realistic evaluation procedures for judging the merits of different coatings.

Realistic evaluation is necessary because, if the testing conditions are more severe than the intended service conditions, some useful systems for solving a particular problem may be overlooked. On the other hand, if the test conditions are less severe than those of the service environment, as is most frequently the case, coating systems could well be carried through needless and costly development programs which would not contribute to the solution of the particular problem at hand.

Some of the properties considered in selecting potential coating materials are: oxidation resistance, thermal expansion characteristics, elastic modulus, thermal conductivity, tensile or fracture strength,

COATING MATERIALS OF CURRENT INTEREST

Each of these materials will provide protection under some set of environmental conditions, but none at present is wholly satisfactory or can be considered the ultimate solution for any particular service requirement.

METALLIC

Iron, nickel, cobalt base—nichrome type, stainless steels, brazing alloys; *Noble metal base*—platinum metals, gold; *Miscellaneous metal base*—chromium plus Ti, Si, and Al additives

INTERMETALLIC

Aluminides plus Ti, Si, Cr, Sn, and Y additives; *Beryllides; Silicides*—$MoSi_2$, $CbSi_2$, $TaSi_2$, WSi_2 plus Cr, B, Al, Ti, and Ni additives; *Miscellaneous*—$CbZn_x$

CERAMIC

Al_2O_3 plus glass; Other refractory oxides plus impregnants; Glass frits and enamels; Zircon

CERMET

$Ni\text{-}SiO_2$; $Cr\text{-}ZrO_2$; $Ni\text{-}ZrO_2$; $W\text{-}ZrO_2$

stability toward chemical reaction and interdiffusion with the substrate, thermal shock resistance, and gaseous transport characteristics.

Although each application for a coated system has its own set of environmental factors, coated systems generally must be evaluated with respect to one or more of the following conditions: tension, compression, impact, fatigue, creep, bending, vibration, shear, elongation, thermal shock, erosion, hypersonic air flow, notch sensitivity, and defect tolerance. Also, in re-entry applications, the emissivity of the coated system can be of major importance.

After a good coating system has been produced, there remain problems of education of personnel, inspection, and repair. Coated systems, in general, do not withstand much physical abuse, and a special educational program is frequently required for production personnel. Even with special educational programs, coated systems may suffer damage or be produced with flaws. Reliable nondestructive test methods are urgently needed in the current state of the art of protective coatings for the refractory metals.

CLASSES OF COATINGS AND THEIR APPLICATION

Substrate	Promising Systems	Interesting Systems
CLASS I–2000 TO 2500 F, 50 TO 100 HOURS		
Mo	Sprayed Al_2O_3 over Cr plate.	....
Cb	....	Glass impregnated Al_2O_3, sprayed.
Ta	....	....
W	....	....
CLASS II–2500 TO 3000 F, TO SEVERAL HOURS		
Mo	Silicide + additives, pack cementation.	Pt, electroplated.
	Sprayed Al_2O_3 over Cr plate.	Al-Si, sprayed.
Cb	Aluminide + additives, hot dip with diffusion treatment, etc.	....
	Cr-Ti + Si, Al additives, vapor diffusion.	....
	Silicide + additives, pack cementation.	....
Ta	....	Aluminide + additives, hot dip with diffusion treatment, etc.
	....	Silicide + additives, pack cementation.
	....	Beryllide, vapor diffusion.
W	....	Silicide, pack cementation.
CLASS III–OVER 3000 F, TO SEVERAL HOURS		
Mo	....	....
Ta	....	....
W	....	....

Methods for Preparing Coated Systems

Methods which have been studied for applying coating materials to refractory metal substrates are:

Plating from solution—fused salt electrodeposition, aqueous electrodeposition, and aqueous electrophoretic deposition;

Chemical reaction deposition—vapor plating and pack cementation;

Hot spraying—flame spraying and plasma spraying; and

Mechanical deposition—vacuum metallizing, cladding, hot and cold dipping, and paint and sinter.

Each method has its own sets of advantages and disadvantages for any given combination of substrate, coating material, and service condition for protection.

Difficulties Encountered

Research and development programs on protective coatings frequently take considerable time before they proceed from simple static oxidation testing to advanced evaluations under simulated service environments because they are plagued with a multiplicity of difficulties. Among the problems frequently encountered are: (1) thermal expansion mismatch; (2) pinholes; (3) difficulty of corner, edge, and recess protection; (4) poor bonding; (5) excessive diffusion; (6) interconnecting porosity; (7) brittleness; (8) lack of defect tolerance; and (9) low-temperature "pest" failures.

The microphoto to the left on page 11 shows part of a coated system which exemplifies problems 1, 3, and 7; this particular system is in the as-prepared condition. The microphoto on the right shows the same system after being subjected to air at 2700 F for 22 hours; interdiffusion of the coating and the substrate has caused considerable alteration of the as-prepared coating.

Current Status of Protective Coatings

The current status of protective coatings for the four principal refractory metals can be presented from

the standpoint of three different temperature-time applications as follows:

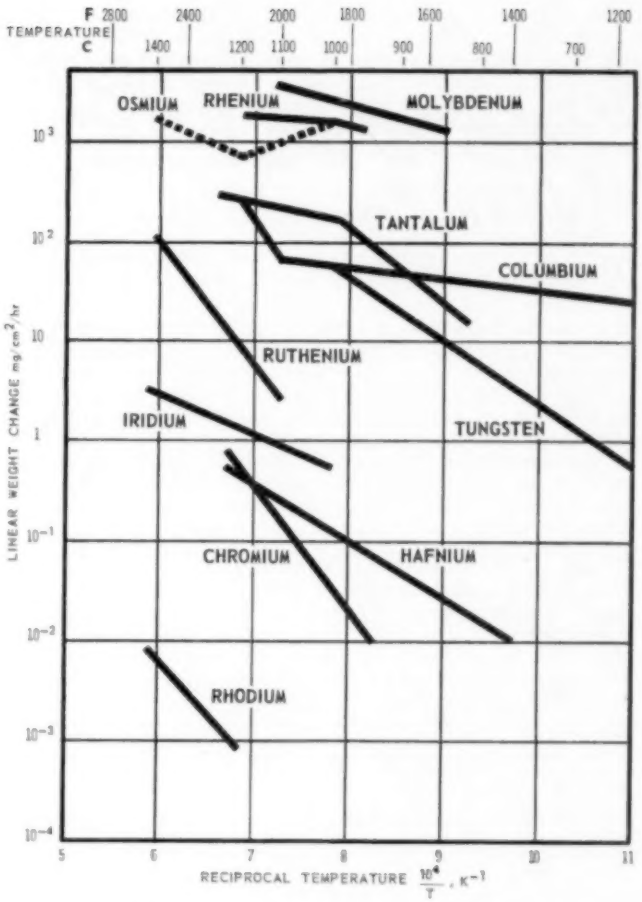
Coating Class	Temperature, F	Time, hrs.
I	2000-2500	50-100
II	2500-3000	Up to several
III	Over 3000	Up to several

Each coating class can be further broken down roughly into "promising" and "interesting" systems. A promising system is defined as one which appears to have potential for accomplishing a class of mission based on the evaluation results obtained from more than one source. An interesting system is defined as one which appears to have potential for accomplishing a class of mission based on the evaluation results from only a single source.

Coating systems emerging from these breakdowns are shown on page 14.

The present status of protective coatings for refractory metals must be termed as one of predominantly research and development. Coatings for molybdenum have been under investigation for the longest period of time and have received the most attention. Significant progress on coatings for columbium and tantalum has been made during the past year.

Many problems remain unsolved at the present time; and, as some of the current research programs progress to more advanced stages, new problems will be uncovered. All of these problems must be attacked by sound research and development programs if the refractory metals are going to be reliably protected from oxidation. Then they may take their proper position in the directory of construction materials which can move our technology forward into the region of higher and higher temperatures.



Changes in oxidation rate of refractory metals in relation to temperature. Data for molybdenum, rhenium, osmium, ruthenium, iridium, and rhodium are weight-loss rates.

SCIENTISTS AND A FUTURE-DIRECTED SOCIETY

"Any scientist realizes that his subject is moving in time—that he knows incomparably more today than better, cleverer, and deeper men did twenty years ago. He knows that his pupils, in twenty years, will know incomparably more than he does. Scientists have it within them to know what a future directed society feels like, for science itself, in its human aspect, is just that. That is my deepest reason for wanting scientists in government . . .

"We [of the West] are immensely competent; we know our pattern of operations like the palm of our hands. It is not enough. That is why I want some scientists mixed up in our affairs. It would be bitter if, when this storm of history is over, the best epitaph that anyone could write of us was only [this]: 'The wisest men, who had not the gift of foresight:' "

C. P. Snow, in his Godkin Lectures, Harvard University

Writings by STAFF Members

Reaction of Pure Tantalum With Air, Nitrogen, and Oxygen. Kinetic studies were made of the reactions of Ta with O, N, and air at 400 to 1500 C. The Ta-O reaction is linear from 500 to 1250 C. The Ta-N reaction follows a cubic rate law at 400 to 700 C and a parabolic rate law at 800 to 1475 C. The reaction behavior in air is initially parabolic followed by a transition to linear behavior. ***W. M. Albrecht, W. D. Klopp, B. G. Koehl, and R. I. Jaffee.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 221, no. 1, Feb., 1961, pp. 110-117.

Effects of Fast Neutrons on Silicon Carbide. Bulk *n*-type specimens of silicon carbide and silicon carbide junction rectifiers were irradiated with fast neutrons and gamma-rays. Fast neutron irradiation decreased the carrier concentration in bulk specimens. Up to a total irradiation of 10^{16} fast neutrons/cm^2, the changes in current-voltage characteristics appear to be due to ionization. The application of large reverse voltages while in the radiation field tends to increase the resistance and decrease the slope of the reverse characteristic toward an ohmic relationship. ***L. W. Aukerman, H. C. Gorton, R. K. Willardson, and V. E. Bryson.*** Paper from *Silicon Carbide. A High Temperature Semiconductor,* pp. 388-394, 1960. Pergamon Press, New York.

A Comparison of Stainless Steel and Zirconium for Use in Pressurized Water Reactors. Advantages and disadvantages of Zr-2 and SS cores using fully enriched uranium have been compared. It has been shown that SS cores are considerably cheaper (about 40 per cent) to buy than Zr-2 cores, that SS possesses greater resistance to hydride formation and better mechanical properties both in the irradiated and unirradiated conditions, and that SS can be used in very compact cores while U-Zr alloys cannot. However, SS cores are reactivity limited (i.e., require a considerably larger critical mass) and present a more serious activity buildup problem than zirconium cores. The possibility of considerably increasing the life of a core by using Zr-2 instead of SS is the most important advantage of the U-Zr type cores. The activity buildup problems are also very important considerations which cannot be overlooked when comparing the two types of cores. ***Charles J. Baroch.*** *Mines Magazine,* v. 51, Feb., 1961, pp. 17-22.

Performance of Work to Develop Methods for Production of Infrared Interference Filters in the Range 4.5 to 15 Microns Using Semiconductor Material as Interfering Layers and Different Carrier Plates, Such as Sapphire, Mica Arsenic Trisulfide, or Silver Chloride. Attempts were made to prepare these filters by evaporating the interference layer onto the carrier plates under vacuum. Different combinations of filter materials were employed in the examinations, and the following parameters were varied: material of the carrier plate, material of the interference layers, number of the interference layers, thickness of the interference layers. PB 149657; Battelle Institut e.V., *Final Report for Dec. 1, 1958-Feb. 29, 1960,* 43 pp. (LC mi $3.30, ph $7.80)

Hydrogen Pickup During Aqueous Corrosion of Zirconium Alloys. Hydrogen absorption during the corrosion of zirconium alloys has been studied in 600 and 680 F water and 750 F 1500-psi steam. Results on binary sponge-base alloy series indicate that, of the alloying elements found in Zircaloy-2, Ni at increasing levels markedly increases H absorption. Tin has little or no effect, while Fe and Cr additions reduce H absorption. Antimony additions also reduce H absorption. However, additions of As, Sb, Bi, or Te to Zircaloy-2 do not affect the amount of H absorbed during corrosion. It is postulated that in zirconium alloys containing Fe, Cr, or Ni the compounds of these elements are cathodic to the Zr matrix. The resulting potential difference is sufficiently high to anodically polarize the Zr and thus improve corrosion resistance. Apparently Fe and Cr compounds readily depolarize H and thereby decrease the possibility of its passage through the oxide film. Nickel compounds probably do not depolarize H and may aid in its passage through the oxide film. ***Warren E. Berry, Dale A. Vaughan, and Earl L. White.*** *Corrosion,* v. 17, March, 1961, pp. 81-89.

Review of Some Unconventional Methods of Machining. Covers principles and applications of four electrical machining techniques, as well as some information on chemical and ultrasonic methods. ***Francis W. Boulger.*** PB 161225: Battelle Memorial Institute. Defense Metals Information Center, *DMIC Memorandum 75,* Nov. 29, 1960, 20 pp. (OTS $0.50)

Centrifugal Casting of Aluminum-Uranium Alloys. The best castings were produced by using a pouring temperature of 2400 F, a heavy-walled steel cylinder rotating between 700 to 900 rpm for the mold, and a bottom-pouring technique employing a retractable pouring spout. Sound, nonporous billets 26 in. long and 5 in. in diameter were produced with a yield after machining of over 75% of the original charge. ***Norman E. Daniel, Ellis L. Foster, Jr., and Ronald F. Dickerson.*** U.S. Atomic Energy Commission, *BMI-1363,* July 20, 1959, 26 pp. (LC mi $2.70, ph $4.80)

Progress Relating to Civilian Applications During July and August, 1960. Gives status of work being done at Battelle on radioisotope and radiation applications and on nuclear reactor materials, fuels, and components. ***Russell W. Dayton and Clyde R. Tipton, Jr.*** U.S. Atomic Energy Commission, *BMI-1455,* August, 1960, 79 pp.; *BMI-1464,* September 1, 1960, 75 pp. (OTS each $2.00)

Niobium-20 w/o Uranium, High-Temperature Metallic Fuel of the Future. An alloy containing niobium-20 w/o uranium has been developed for reactor fuel applications. The fabrication characteristics, mechanical properties, and corrosion behavior in air, CO_2, NaK, water, and steam were studied. After consumable arc melting, the alloy was successfully forged at 1370 C (2500 F) and rolled at 980 C (1800 F) to sheet. Representative specimens of this alloy showed only slight reductions in hardness up to 900 C (1650 F), The 0.2% offset at 870 C (1600 F). At a stress of 63,000 psi at 870 C (1600 F), 200 hr. were required to cause rupture. Other metallurgical data are listed. ***John A. De Mastry, Frederic R. Shober, and Ronald F. Dickerson.*** *Nuclear Science and Engineering,* v. 9, March, 1961, pp. 299-304.

Sculpturing Hard Metal. Significant features of electrolytic shaping are: There is no physical contact between tool and workpiece, hence, there is no pressure on the workpiece; ultrathin metals can be electrosphaped as easily as heavy sections; no burrs develop; the process is noiseless and there are no sparks, no chatter, no crunch, and no dust; and the process is simple to operate. ***Charles L. Faust.*** *Industrial Science and Engineering,* v. 8, no. 4, February, 1961, pp. 27-30.

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Examination of Titanium Steam Coil From a Purex Evaporator. Failure occurred in a section of coil after about six months service. Metallographic and other studies indicated that no hydrogen pickup occurred during service and that the failure was mechanical rather than chemical or metallurgical in nature. ***F. W. Fink.*** U.S. Atomic Energy Commission, *TID-5724,* March 31, 1960, 7 pp. (LC mi $1.80, ph $1.80)

Corrosion of INOR-8 and Inconel Dissolver Components of the Fluoride-Volatility Process. Corrosive attack can be minimized by increased wall-section thickness at interface areas, maintaining presence of zirconium at all times, operation at lowest possible temperature feasible from other considerations, and periodic examinations of internal components for selective attack. ***F. W. Fink.*** U. S. Atomic Energy Commission, *AECU-4633,* December 30, 1959, 45 pp. (LC mi $3.30, ph $7.80)

Availability and Mechanical Properties of High-Strength Steel Extrusions. Six classifications of high-strength steels are considered. Typical current extrusion specifications are discussed, and illustrative mechanical properties are reported. Some attention is devoted to anticipated future consumer requirements. ***R. J. Fiorentino and A. M. Sabroff.*** PB 151079; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Report No. 138,* October 26, 1960, 60 pp. (OTS $1.75)

Tool Materials for Machining. Surveys carbon tool steel, high speed steel, cast alloys, cemented carbides, ceramics, and diamonds. ***Roland B. Fischer.*** Paper from *Encyclopedia of Chemical Technology,* 2nd suppl. v., pp. 873-882, 1960. Interscience Encyclopedia, Inc., New York.

Notes on Large-Size Furnaces for Heat Treating Metal Assemblies. The bottom-open gantry furnace using an endothermic protective atmosphere is the most frequent type of installation for these large furnaces. This type of furnace allows loading from or quenching into a pit below the furnace without losing the protective atmosphere or exposing the part to the air. The endothermic protective atmosphere is the most popular because it is easy to control the carbon potential with this gas by regulating the dew point. ***H. J. Hucek, A. R. Elsea, and A. M. Hall.*** PB 161213; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 63,* August 25, 1960, 9 pp. (OTS $0.50)

Notch Sensitivity of Refractory Metals. The tensile and notch tensile properties of four refractory metals, molybdenum, tungsten, columbium, and tantalum, and one alloy, Mo-0.5Ti, were investigated at five temperatures selected to encompass the brittle-to-ductile transition. All specimen failures were classified according to fracture mechanism. The notch sensitivity of each material was evaluated by analyzing the notch and unnotch tensile strength, the ductility transition, and fracture transition. ***Albert G. Imgram, Frank C. Holden, et al.*** PB 171198; U.S. Air Force, Wright Air Development Division, *WADD Technical Report 60-278,* September, 1960, 115 pp. (OTS $2.50)

Titanium Founders Day. Outlines the proceedings of this meeting and discusses the four problems which are met with new materials: (1) how to introduce a new material; (2) how to deal with critical problems; (3) how to forecast requirements; and (4) how to provide support. ***R. I. Jaffee.*** *Journal of Metals,* v. 13, January, 1961, pp. 55-56.

Investigation of the Infrared Absorption of Selected Aromatic Compounds in the Region of 2 to 35 Microns. Complete vibrational assignments are made for phenol, p-xylene, p-cresol, and hydroquinone. Infrared spectra of the selected para-substituted phenols are recorded over the 2- to 35-micron range. With the aid of these infrared data and of Raman spectra, most of the low-frequency vibrations are assigned. Correlation studies of frequency with physical properties are made for the assigned frequencies that are sensitive to the nature of the substituent. ***R. J. Jakobsen.*** PB 171342; U.S. Air Force, Wright Air Development Division, *WADD Technical Report 60204,* September, 1960, 44 pp. (OTS $1.25)

Melting and Casting of the Refractory Metals Molybdenum, Columbium, Tantalum, and Tungsten. The technology of melting and casting refractory metals is considered from the standpoint of ingots and shaped castings. The production of ingots is more advanced than is the production of shaped castings. Molybdenum and Cb have been centrifugally cast with some success. Shaped castings of Ta have been produced experimentally. No satisfactory method for the production of shaped W castings is presently available. There is an indicated need for shaped castings of the refractory metals, and further development work appears to be justified. The cold-crucible induction furnace, presently under development for Ti, might be adapted for the refractory metals. ***W. H. Johnson.*** PB 151098; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Report No. 139,* November 18, 1960, 30 pp. (OTS $1.00)

Phthalocyanines as High-Temperature Lubricants. Demonstrates that metal-free phthalocyanine is a potential lubricant for extreme conditions of load and temperature. For the conditions under which the experiments were performed, metal-free phthalocyanine is most efficient as a lubricant in the temperature range of 800 to 1350 F. ***H. H. Krause, S. L. Cosgrove, and C. M. Allen.*** *Journal of Chemical and Engineering Data,* v. 6, no. 1, January, 1961, pp. 112-118.

Biochemical Semiconductors. A General Survey of Mechanisms. There are organic compounds possessing a potentially high conductivity such as in the phthalocyanines. Inasmuch as there are similar structures in tissue, that is, the metal-free porphyrins, it is reasonable to conjecture that these structures may be responsible for electrical conductivity. Whether monofree radicals are possible with the sodium and potassium derivatives and the manner in which the various alkali metals react with the porphyrins remain, at present, unanswered questions. Nevertheless, the fact that high concentrations of potassium ions possess a curare-like effect on nerves similar to that noted with quaternary ammonium derivatives may not be without significance. ***Edward L. Kropa.*** *Texas Reports on Biology and Medicine,* v. 18, no. 4, Winter, 1960, pp. 543-557.

Applications of Continuous Brewing Processing. Discusses continuous wort production and continuous fermentation from the standpoint of practical application and its economical advantages for the farsighted brewer. ***John H. Litchfield and Herman Nack.*** *Modern Brewery Age,* v. 62, no. 23, December, 1960, p. 40 + 2 pages; v. 63, no. 1, January, 1961, p. 32 + 2 pages.

The Role of Technical Societies. The primary task of technical societies is to advance and disseminate scientific and technical knowledge. No one these days can know all about any one thing. Technical societies today offer us an opportunity to tap almost as rapidly as they are generated the best sources for new scientific and technical information that we need in our research planning. There are no other agencies open to such world-wide sources where technical information can be gathered as promptly and completely as through such society functions as meetings, seminars, conferences, technical discussions, and current technical publications. The larger societies must constantly reevaluate the services they offer, keeping in mind that they must remain at least abreast, and preferably ahead, of the tide of technological change. Instead of a great number of societies struggling to keep alive, we should have a strongly coordinated group made up of large and well-established technical societies that are capable of performing the normal as well as the specialized tasks they are called upon to do. ***C. H. Lorig.*** *Materials Research & Standards,* v. 1, March, 1961, pp. 201-202.

Practical Information Handling. Extensive experience with the qualitative approach to scientific information has demonstrated that it is effective in meeting the needs of both occasional and regular users by simplifying and speeding up their information-searching task. Such an approach benefits serious seekers of information because the information they use is what they selected and each person's selection is the most precise for him. The occasional user profits from the qualitative approach by virtue of selections made by the regular and more knowledgeable users. ***John W. Murdock and Gustavus B. Simpson, Jr.*** *Industrial Research,* v. 3, no. 2, April-May, 1961, pp. 41-43.

Titanium and Titanium Alloys. Discusses production, properties, heat treatment, prices, and uses. ***H. R. Ogden.*** Paper from *Encyclopedia of Chemical Technology,* 2nd suppl. v. pp. 866-873, 1960. Interscience Encyclopedia, Inc., New York.

Research on Control of Emissions From Bessemer Converters. Data were taken from a laboratory-scale Bessemer converter to determine reactions involved in the formation of waste gases and solids during operation of the converter, and the composition of these emission products. ***Alexander R. Orban, John D. Hummell, and George G. Cocks.*** *Air Pollution Control Association, Journal,* v. 11, no. 3, March, 1961, pp. 103-113.

Progress on the Use of Gas-Pressure Bonding for Fabricating Low-Cost Ceramics, Cermet, and Dispersion Fuels. Phase II Report on AEC Fuel-Cycle Program. Uranium dioxide clad with Type 304 stainless steel was fabricated into rod, tubular, and flat-plate shapes. Through the selection of initial oxides and compacting procedures, final oxide densities of 86 to 99.5% of theoretical were achieved. Mixtures of ceramic and fused oxides appear to offer most promise in achieving low-cost fuel elements through the pressure-bonding process. ***Stan J. Paprocki, editor.*** *U.S. Atomic Energy Commission, BMI-1475,* November 7, 1960, 92 pp. (OTS $2.00)

Uranium Migration in UO_2-Bearing Ceramics. A preliminary study was made of uranium migration in pressed and sintered UO_2-bearing bodies based on $MoSi_2$ or Al_2O_3. For $MoSi_2$-core bodies containing 23 wt % of UO_2 clad with UO_2-free $MoSi_2$, migration of uranium was limited to less than 0.002 in. during sintering at 2700 F and subsequent exposure in air at 2500 F for 140 hr. Attempts to fabricate impervious Al_2O_3-base core bodies containing up to 46.2 wt % of UO_2 were not successful using powder compacts and sintering in the purified atmospheres required to maintain uranium placement. ***J. F. Quirk, E. F. Ferrell, A. K. Smalley, and W. H. Duckworth.*** U.S. Atomic Energy Commission, *BMI-862,* September 4, 1953, 34 pp. (LC mi $2.70, ph $4.80)

Some Metallurgical Aspects of CO_2-Shielded-Arc Welding. Sound welds with good mechanical properties can be deposited in a variety of steels such as plain carbon, austenitic stainless, heat-resistant and low-alloy, high-strength steels. Welds are reported to have high resistance to both hot and cold cracking. The process is adaptable to the joining of plates ⅛ to 6 or 7 in. thick, with high deposition rates, good weld appearance and low inclusion count. ***M. D. Randall, R. J. Rieppel, S. L. Hoyt, and A. F. Chouinard.*** *Welding Journal,* v. 40, April, 1961, pp. 169s-174s.

New Data on the Performance of Nickel and Chromium Plated Zinc Die Castings. Data presented demonstrate that the endurance of electroplated zinc die castings can be markedly improved with any one of three composites having minimum plate thicknesses as follows: Copper–0.3 mil, duplex nickel–1.2 mils, and chromium–0.1 mil; copper–0.3 mil, duplex nickel–0.8 mil, and crackfree chromium–0.03 to 0.05 mil; and copper–0.3 mil, bright nickel–0.8 mil, and micro-cracked chromium–0.1 to 0.15 mil. ***W. H. Safranek, H. R. Miller, R. W. Hardy, and C. L.. Faust.*** Paper from *Technical Proceedings of the Forty-Seventh Annual Convention, American Electroplaters' Society,* July 24-28, 1960. pp. 96-104, 1960. American Electroplaters' Society, Inc., Newark, New Jersey.

Mechanical Properties of Zirconium and Zirconium-Uranium Alloys Containing Tin. Tensile data are given for room temperature, 500, and 600 F; hot-hardness data from room temperature to 1600 F, with particular emphasis on the hot-rolling range; and creep and fatigue data at 500 F. ***A. D. Schwope, G. T. Muehlenkamp, and W. Chubb.*** U.S. Atomic Energy Commission, *BMI-770, September* 29, 1952, 23 pp. (LC mi $2.40, ph $3.30)

Uniformity of Electrical Current Flow in Cylindrical Semiconductor Specimens With Cylindrical Metallic End Caps. The distribution of current is computed in a cylindrical semiconductor specimen provided with cylindrical metallic end caps of the same diameter as that of the specimen and electrical lead wires of much smaller diameter. Nonuniformity of the longitudinal current density of 1% or less can be obtained in specimens with electrical resistivities at least 200 times greater than that of the end caps if the lengths of the specimens are at least equal to their diameters and if the length of each end cap is at least 0.3 diam. ***R. Simon, J. H. Cahn, and J. C. Bell.*** *Journal of Applied Chemistry,* v. 32, No. 1, Jan. 1961, pp. 46-47.

Explosive Metalworking. The use of intricate shapes formed from high-strength refractory metals, as well as the forming of large parts from these and other materials, has necessitated the development of a process by which the tremendous energies required to form these desired shapes could be generated. The purpose of this memorandum is to explain in generalities the principles of impulsive or explosive forming, a technique by which such energies can be developed. ***Charles C. Simons.*** PB 161221; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 71,* Nov. 3, 1960, 30 pp. (OTS $0.50).

Suppression of Pulsations in Oil-Fired Residential Heating Equipment. Summarizes and discusses the various techniques for suppressing pulsations in oil-fired heating equipment. Techniques are divided into two main categories–those used to combat changes affecting the acoustic pressure oscillations and those used to combat changes affecting the periodic heat release. ***C. F. Speich and A. A. Putnam.*** *ASHRAE Journal,* v. 3, Jan. 1961, p. 49. 7 pages.

Determination of Interstitial Solid-Solubility Limit in Tantalum and Identification of the Precipitate Phases. Solid-solubility limits at 1500, 1000, and 500 C for C, N, and O in high-purity Ta were determined by X-ray lattice-parameter methods. For C, the solubility was found to be 0.17 a/o at 1500 C and less than 0.70 a/o at 1000 C. Nitrogen solubility of 3.70 a/o at 1500 C decreases linearly with temperature to 2.75 a/o at 1000 C and 1.8 a/o at 500 C. In the case of O, the solubility was found to be 3.65 a/o at 1500 C, 2.95 a/o at 1000 C, and 2.5 a/o at 500 C. ***Dale A. Vaughan, Oliver M. Stewart, and Charles M. Schwartz.*** U.S. Atomic Energy Commission, *BMI-1472,* Oct. 28, 1960, 28 pp. (OTS $0.75).

High-Velocity Metalworking Processes Based on the Sudden Release of Electrical Energy. Methods differ chiefly in the manner in which the electrical energy is converted to the mechanical energy used to deform the metal. In one method, a high-amplitude, short-duration current pulse is used to create an underwater shock wave, either by causing a spark to jump across a submerged spark gap or by literally exploding a submerged filament wire in the vicinity of the workpiece. In another method, the current pulse produces a rapidly changing magnetic field in a coil. This changing magnetic field exerts a force on the workpiece. Each of the processes is discussed separately. ***H. J. Wagner and F. W. Boulger.*** PB 161220; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 70,* Oct. 27, 1960, 15 pp. (OTS $0.50).

Stabilizing Effects of Oxide Additions to Uranium Oxide. CaO may be successfully employed in partial substitution for La_2O_3 and Y_2O_3. The resulting solid solutions exhibited high-temperature stability comparable to that of the "binary" solid solutions of UO_2 containing La_2O_3 or Y_2O_3. On the basis of these and other results some alternative approaches appear possible to reduce the amount and cross section of additive required for stabilization. ***Wendell B. Wilson and Arnold F. Gerds.*** U. S. Atomic Energy Commission, *BMI-1467,* Sept. 15, 1960, 13 pp. (OTS $0.50).

Emissivity and Emittance, What Are They? The two main classifications of radiation sources, total radiation and spectral radiation, are defined and discussed. Emittance, emissivity, and related properties are defined and their relationships to the basic laws governing thermal radiation were shown. Some general considerations derived from the radiation laws are included as an aid in the better use and understanding of the radiation data found in the literature. ***W. D. Wood, H. W. Deem, and C. F. Lucks.*** PB 161222; Battelle Memorial Institute, Defense Metals Information Center, *DMIC Memorandum 72,* Nov. 10, 1960, 17 pp. (OTS $0.50).

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

Engineering or Research. Discusses which should be emphasized in a company's over-all planning. ***Delmar W. Karger and Robert G. Murdick.*** *Machine Design,* v. 33, Mar. 16, 1961, p. 130-134.

Does Research Go Far Enough? Booming research and development outlays by U. S. industry must be extended to manufacturing research, or the outlay is wasted. *Iron Age,* v. 187, no. 14, Apr. 6, 1961, p. 68.

The Role of Science in American Manufacturing Progress. Future improvements in American productivity will be largely dependent on the application of science to manufacturing. This depends in turn on the availability of large numbers of scientifically trained tool and manufacturing engineers. The universities can serve the needs of industry in two ways: by performing basic research and by graduating well-qualified engineers in the manufacturing field. ***A. B. Drought.*** *Tool and Manufacturing Engineer,* v. 46, no. 5, Apr. 1961, p. 57-60.

* **Estimating Changes in the Research Budget.** Successful research management requires the optimal allocation of the research budget among those prospective projects promising a return in excess of that which the stockholders could receive if given these funds as dividends. The problem confronting the research director is to maximize the total present value of the various anticipated incomes from the alternative projects, given the research budget constraint within which he must operate. ***Ira Horowitz.*** *Journal of Industrial Engineering,* v. 12, no. 2, Mar.-Apr. 1961, p. 114-118.

Current Projects on Economic and Social Implications of Scientific Research and Development, 1960. Presents the findings of the second annual survey of projects in the U. S. In this survey, the scope is broadened to include not only academic institutions but also private foundations and nonprofit research institutions. 124 pp. 1961. National Science Foundation, Washington, D. C. (T176 N21.7c)

Ideas, Inertia, and Achievement. Reports conclusions of selected corporations, scientific institutions, and individuals devoted to shortening the time lag between original scientific discovery and engineering application. ***Fenton B. Turck, compiler.*** 183 pp. 1960. The American Society of Mechanical Engineers, New York. (Q180.A1 T84i)

Battelle Memorial Institute. Discusses some of the factors in our scientific and technological complex which contribute to the time lag between original scientific discovery and engineering application from the standpoint of a research institute, and suggests remedies for overcoming the problems involved. ***David C. Minton, Jr.*** Paper from "Ideas, Inertia, and Achievement", p. 139-143, 1960. The American Society of Mechanical Engineers, New York. (Q180.A1 T84i)

Promise of New Products Spurs Research Growth. A survey just released by the McGraw-Hill Department of Economics indicates that research this year will touch $10.5 billion compared with $9.8 billion last year. And company managements envision an increase to $11.7 billion by 1964. The figures include only that portion of government R & D being spent by industry; it excludes government R & D at universities and government labs. *Product Engineering,* v. 32, no. 19, May 8, 1961, p. 15-16.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

A Homing Parachute System. ***Milton T. Kane, H. K. Dicken, and R. C. Buehler.*** *U. S. Atomic Energy Commission,* SC-4537(RR), Jan. 1961, 37 pp. (UF767 Un3.1sc Contin.)

* Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

The Effects of Flow Obstructions on an Oscillating Free Convection Boundary Layer on a Heated Vertical Plate. The effects of three types of flow obstructions on artificially induced free convection boundary layer oscillations were measured with a Zehnder-Mach interferometer. The obstructions were: a wedge, a convex surface, and a flat surface. It was found that the convex surface produced a slightly greater damping effect than the flat surface while both the convex surface and the flat surface produced considerably larger effects than the wedge. ***Jack P. Holman, Kenneth E. Stout, and Erich E. Soehngen.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Note* 60-24, Oct. 1960, 33 pp. (TL507 Un3.18t Contin.)

Aerodynamics of Blasts. Some consideration is given to intense explosions from concentrated energy sources for spherical, cylindrical, and planar blasts, and explosions and implosions generated from finite sources with the same geometries. Blast-wave simulators for aerodynamic tests and the dynamic testing of structural components are briefly discussed. ***I. I. Glass.*** *Toronto University, Institute of Aerophysics, UTIA Review No.* 17, Sept. 1960, 35 pp. + 43 figures. (TL570 T64.84r Vis.)

Thermodynamic Calculations of Hydrogen-Oxygen Detonation Parameters for Various Initial Pressures. Composition, temperature, pressure and density behind a stable detonation wave and its propagation rate have been calculated for seven H-O mixtures at 1, 5, 25 and 100 atm initial pressure, and at an initial temperature of 40 C. For stoichiometric mixtures the calculations also include an initial temperature of 200 C. According to these calculations the detonation velocities of H-O mixtures increase with increasing initial pressure, but decrease slightly when the initial temperature is raised from 40 to 200 C. The calculated detonation velocities agree satisfactorily with values determined experimentally. These values will be published in the near future. ***Loren E. Bollinger and Rudolph Edse.*** *ARS Journal*, v. 31, Feb. 1961, p. 251-256.

Proposed Ground and Flight Program to Develop Space Age Materials. The motivations for extending our knowledge of the behavior of materials in space are given. A proposed program is developed for accomplishing this. The program is set up to: obtain fuller measurements of the geophysical environments; compile and collate critical geophysical data now scattered throughout a multitude of printed sources; support and extend existing theoretical studies to aid in designing experiments, interpreting and extrapolating the data; extract maximum benefits from presently limited testing opportunities; study means of interpreting tests measuring response to extreme environment forces; and coordinate ground with space testing phases. A description is given of an extensive program presently under way contributing to the attainment of these goals. Requirements for extension of this and similar programs are discussed. ***M. A. Steinberg, J. L. Fox, and B. W. Augenstein.*** *ARS Journal*, v. 31, Feb. 1961, p. 228-236.

Stability of Orthotropic Cylindrical Shells Under Combined Loading. The increasing use of fiber and whisker reinforced materials makes necessary the availability of methods of analyzing cylinders and cones composed of an orthotropic material. This paper treats the buckling of such shells under a combination of axial compression and uniform external pressure. The differential equation approach of Flügg is used, and the resulting buckling equation is presented in terms of axial and circumferential bending rigidities, shear rigidity, Poisson's ratio, geometry parameters and mode shapes. Design curves are presented which allow quick determination of critical loads on cylinders, and, by using the equivalent cylinder concept, on conical shells of small included angle. The curves also lend themselves to "tailoring" of materials to fit the load carrying requirements of the structure. ***T. E. Hess.*** *ARS Journal*, v. 31, Feb. 1961, p. 237-246.

Researches in Interplanetary Transfer. A method is presented by which interplanetary trajectories may be calculated extremely rapidly and to a degree of accuracy suitable for design studies. By splitting the three-center problem associated with interorbital ballistic transfer into three one-center segments which overlap somewhat at their junctions, solutions may readily be found by machine iteration. The extreme speed of the method enables wholesale amounts of worthwhile numerical results to be obtained. Examples presented in the paper include

velocity requirements for trips to and from Mars during the year 1960. Considering that the orbits of Earth and Mars are elliptical and mutually inclined, the Hohmann minimum energy transfer criterion disappears, and the occurrence of several local minimum energy trajectories is observed; this phenomenon is expected to be typical of all interplanetary orbit studies. ***John V. Breakwell, Rollin W. Gillespie, and Stanley Ross.*** *ARS Journal*, v. 31, Feb. 1961, p. 201-208.

Recent Advances in Nonequilibrium Dissociating Gas-dynamics. Reviews some recent advances in the study of gas-dynamic problems including effects of chemical reactions. The discussions of the recent developments are restricted to inviscid flow problems only, neglecting viscosity, heat conduction and diffusion. Particular attention is directed to recent advances in analyses of nonequilibrium dissociating gas flows. ***Ting Y. Li.*** *ARS Journal*, v. 31, Feb. 1961, p. 170-178.

Satellite Networks for Continuous Zonal Coverage. Solutions are obtained to the problem of providing continuous surveillance of latitudinally bounded zones of the globe by means of a particular family of satellite networks. Each network of the family considered consists of satellites equally divided among, and uniformly distributed around, circular orbits of common altitude; the orbit planes are equally inclined with respect to the Equator and symmetrically arranged about the polar axis. Relations are obtained between the number of distribution of satellites used, the characteristics of the network in which they are arranged, and the extent of the continuous zonal coverage they accomplish. These relations are then employed to select from the family of networks considered those which minimize the number of satellites required as a function of altitude for a variety of coverage problems. Results obtained for several representative cases are given graphically. ***R. David Lüders.*** *ARS Journal*, v. 31, Feb. 1961, p. 179-184.

Shock Wave and Flow Field Development in Hypersonic Re-Entry. A study is made of when and how a shock wave and continuum-type flow field develop in the nose region of a highly cooled blunt body re-entering the atmosphere at hypersonic speed and in a free molecular flow regime. The various types of flow regimes encountered down to low altitude conditions are delineated, and the nature of the flow field and behavior of some of the aerodynamic characteristics are discussed. It is shown that for a highly cooled body, free molecule flow conditions occur at a higher altitude than previously indicated. Based on available evidence, it is suggested that kinetic theory solutions, which are essentially modified free molecule results, along with the Navier-Stokes equations with no surface slip, serve to define all of the flow regimes except for a narrow transitional layer regime which has a height of less than one factor of 10 in free stream density change. It is also suggested that the appearance of a definable shock wave occurs rapidly in terms of density change near the beginning of the transitional layer regime, and that its location, as in continuum flow, is governed principally by the body geometry, whereas its thickness is determined by a local mean free path. ***Ronald F. Probstein.*** *ARS Journal*, v. 31, Feb. 1961, p. 185-194.

Aerodynamic Characteristics of Wedges in Low Density Supersonic Flow. Experimental measurements of the lift, drag and pitching moment coefficients of wedge shaped airfoils are presented. The experiments were carried out for 5- and 30-deg half-angle sharp leading edge wedges at Mach numbers of four and six and with Reynolds numbers in the range of 1500 to 8900. The results exhibited strong viscous effects, particularly for the slender wedges, and were in reasonably good agreement with a simplified form of "weak interaction" boundary layer theory for a perfect gas. An extension of this theory indicates the probable importance of heat transfer effects on viscous aerodynamic characteristics. ***S. A. Schaaf, E. S. Moulic, M. T. Chahine, and G. J. Maslach.*** *ARS Journal*, v. 31, Feb. 1961, p. 194-200.

Ballistic Re-Entries With a Varying W/C_DA. An analytical method is presented for evaluating the velocity and deceleration history of a ballistic vehicle experiencing a change in W/C_DA during re-entry. Mass is assumed to be transferred through the process of either ablation or fluid injection into the boundary layer. Vehicle geometry is represented by C_D and A which vary through altitude dependent functions. Gravity and centrifugal forces on the vehicle are neglected, thereby restricting the

analysis to large entrance angles and flight velocities. These simplifying assumptions permit a closed form solution of the re-entry trajectory with variable W/C_DA The governing equation reduces to an incomplete gamma function or exponential integral, depending upon the sign of $d(W/C_DA)/dy$. Results show that the maximum deceleration of the re-entry vehicle is a function of the rate of change of W/C_DA. Furthermore, variable geometry can produce a significant effect on trajectory parameters, such as velocity, deceleration, impact location and heating. ***R. V. Warden.*** *ARS Journal*, v. 31, Feb. 1961, p. 208-213.

Limits for Stable Near-Circular Planetary or Satellite Orbits in the Restricted Three-Body Problem. In the vicinity of two massive bodies rotating in circles around their common center of mass there are regions in which near-circular orbits of a third body are stable, and other regions in which near-circular orbits are unstable. Expressions for calculating the limiting radii of the regions where stable near-circular orbits can exist are developed from Jacobi's integral to the equations of motion of a particle, and computed quantitative values for these radii are given in graphical and tabular form for mass ratios from 10^{-8} to 0.5. An example is given of the application of these limits to an idealized Earth-moon system (mass ratio, 0.012128563). ***S. H. Dole.*** *ARS Journal*, v. 31, Feb. 1961, p. 214-219.

Motion of a Satellite of the Moon. The motion of a satellite of the moon depends chiefly on the force fields of the moon, Earth and sun. If one chooses a frame of reference attached to the moon, it can be shown that the force field resulting from the sun can be neglected when compared with Earth's field on the satellite. The effect of the Earth's field is shown to be of the same order of magnitude as is the moon's perturbing field resulting from its oblateness. The distance between Earth and moon will be assumed to be constant, and satellite orbits of small eccentricity will be studied. The averaging process of Kryloff-Bogoliuboff is applied to the equations of motion for an analysis of this restricted three-body problem, which is further complicated owing to the moon's oblateness. It is shown that a nearly circular polar orbit will digress less than 1 deg from a true polar orbit, and that the change in eccentricity of the orbit is less than a factor of e in one half of a year. An integral of the motion is obtained, such that accurate observations of a nearly circular orbit (not necessarily a polar orbit) will yield values of two fundamental constants related to the principal moments of inertia of the moon. ***Harry Lass and Carleton B. Solloway.*** *ARS Journal*, v. 31, Feb. 1961, p. 220-222.

Testing Techniques for Full-Scale Missile Structures Under Simulated Re-Entry Environment. The intricate pattern of stresses and strains induced in missile structures by the combined environments encountered during re-entry of the earth's atmosphere has necessitated the establishment of unique testing techniques and facilities for evaluating missile performance during this severe phase of flight. ***R. T. Nichols.*** *Experimental Mechanics*, v. 1, Jan. 1961, p. 8-15.

Pilots Report on X-15 Flight Tests. Computers, trainers, and wind tunnel data all were used to ready the X-15 for its build-up flights to Mach 3.3 and 136,500 ft. What was learned in these flights will be applied to the next phase of testing: the bid for Mach 6.4 and 250,000 ft. ***R. M. White and J. A. Walker.*** *Space/Aeronautics*, v. 35, no. 2, Feb. 1961, p. 55-58.

Breguet Scores With Blown-Wing STOL. STOL performance combined with the safety and economy features of conventional fixed-wing design are claimed for the Breguet 941. The French government has backed up its liking for this combination with a prototype order. ***Christopher Dawson.*** *Space/Aeronautics*, v. 35, no. 2, Feb. 1961, p. 51-54.

Ranger: First U. S. Moon Impact Vehicle. Like the weather, everyone talks about the moon, but little has been said about actual hardware to get there. Here is a detailed description of the Ranger series, slated to place the United States' first impact payloads on the lunar surface. ***Irwin Stambler.*** *Space/Aeronautics*, v. 35, no. 2, Feb. 1961, p. 45-50.

Re-Entry Radiation From an IRBM. An account is given of the instrumentation employed and of some of the results that have been obtained. These include radiometric data in several wavelength bands from the ultraviolet to the infrared, and spectra in the visible. ***W. N. Arnquist and D. D. Woodbridge.*** *IRE Transactions on Military Electronics*, v. MIL-5, no. 1, Jan. 1961, p. 19-25. (TK1 In6.6mi Vis.)

Low Resolution Unchopped Radiometer for Satellites. Knowledge of the blackbody temperature and the albedo of Earth and other plants, and the variation of both parameters with latitude, longitude and time, is of great value in understanding the climatic and meteorological conditions of the particular planet. An unchopped radiometer of a wide but restricted field of view is capable of such temperature and albedo measurements. Coated thermistors mounted in highy reflective cones serve as detectors. Their performance as sensor elements is analyzed in detail to prove the feasibility of the measurement. The simplicity of the instrumentation and the low information bandwidth required make the experiment equally attractive for Earth satellites and space probes. ***Rudolf A. Hanel.*** *ARS Journal*, v. 31, Feb. 1961, p. 246-250.

Cosmic Rays, Nuclear Reactors, and Manned Space Systems. Time variations and steady-state cosmic radiation conditions are presented. Steady-state biological intensities are given both for low-altitude orbits as functions of orbital inclination to the plane of the earth's equator, and for paths lying far above the earth's surface. Total allowable nuclear-reactor radiations in the cosmic-ray background are next calculated as functions of satellite orbital inclination and exposure time. These reactor radiation intensities give no more than the recommended maximum doses as stipulated by the U. S. Committee on Radiation Protection. A method of obtaining minimum weight-reactor shields also is outlined, and a hand computation performed for a nuclear 300-kw electrical system. ***David Reitz.*** *Aero/Space Engineering*, v. 20, Apr. 1961, p. 28 + 20 pages.

* **Satellite Guidance.** A survey. ***Bernard Lee.*** *Missile Design & Development*, Mar. 1961, p. 38 + 4 pages.

Aircraft Launching and Recovery Systems. Recent Advances and Their Potential Application to Commercial Aircraft. I. The first in a series of two articles describing the U. S. Naval Air Test Facility (Ship Installations) referring to the over-all description of the test sites and details of launching systems. ***William C. Fortune.*** *Aero/Space Engineering*, v. 20, Apr. 1961, p. 12 + 5 pages.

* **The Design of Wing Plan Forms for Transonic Speeds.** A method is suggested for designing the shape of the plan form of an unwarped swept-back wing so as to control the magnitude of the singularity that occurs in the chordwise loading distribution at the leading edge. At a Mach number of unity it is possible to do this simply and directly by an approximate application of linearized lifting-surface theory. Details are given of three families of wing plan forms, of varying sweep and aspect ratio, in all of which the strength of the leading-edge singularity is held constant near the wing tips, behind the Mach line from the root trailing edge. The local chordwise load distributions have been calculated in detail for several of these wings and it is found that in all cases the loading curves become effectively independent of spanwise position over that part of the span for which the singularity is constant. ***R. C. Lock.*** *Aeronautical Quarterly*, v. 12, pt. 1, Feb. 1961, p. 65-93.

The Inflated Satellite. Characteristics in Sunlight and Darkness. Investigation results are presented of an inflated satellite as it passes from sunlight to darkness and back again into sunlight. Although the Project Echo satellite was used as the model, the analysis obtained is applicable in more general categories. ***Herman Mark and Simon Ostrach.*** *Aero/Space Engineering*, v. 20, Apr. 1961, p. 10 + 6 pages.

* **The Analysis of Fuselages of Arbitrary Cross-Section and Taper.** The general theory of the cut-out and modification analysis is reviewed and extended for a structure involving primary, secondary and tertiary redundances. Some important points of practical application are illustrated on simple examples and the influence of the form chosen for the unassembled flexibility matrix is discussed. The question of the selection and number of actual cuts which will simulate a given major cut-out is treated in general and illustrated on a simple type of structure. ***J. H. Argyris and S. Kelsey.*** *Aircraft Engineering*, v. 33, Apr. 1961, p. 103-104.

AGRICULTURE

Seed Cleaning by Electrostatic Separation. ***J. E. Harmond, N. R. Brandenburg, and D. E. Booster.*** *Agricultural Engineering*, v. 42, Jan. 1961, p. 22-25.

*** Analyses of the Differential Radiosensitivity of Developing Reproductive Tissues in *Habrobracon juglandis* (Ashmead) to Ionizing Radiation.** ***Howard E. Erdman.*** *International Journal of Radiation Biology*, v. 3, no. 2, Mar. 1961, p. 183-204.

Goals for Agricultural Engineering Research. ***G. Wallace Giles.*** *Agricultural Engineering*, v. 42, Apr. 1961, p. 179 + 3 pages.

*** Fecundity and Fertility of Two Strains of the Plum Curculio, Reciprocal Crosses and the F_1 Generations.** There cross from that of the northern and laboratory strains and the was a highly significant decrease in the fertility of the N x L reciprocal cross. Since many eggs contained fully developed but dead embryos, it is suggested that some form of incompatibility exists between the laboratory male and the northern female. The authors suggest that the possibility of reducing the biotic potential of the species in nature through the release of selected strains is deserving of further study. ***J. O. Stevenson and E. H. Smith.*** *Journal of Economic Entomology*, v. 54, no. 2, Apr. 1961, p. 283-284.

BIOCHEMISTRY AND BIOPHYSICS

Vitamins and Hormones. Advances in Research and Applications. Discusses physiology and biochemistry of biotin, biochemistry of Vitamin E, ascorbic acid and collagen fiber formation, nutritional factors and skin diseases, the neuroendocrine system of arthropods, effects of hormonal imbalances on dietary requirements, chemistry and pharmocology of angiotensin, symposium on Vitamin A, synthesis and labeling of Vitamin A and related compounds, physicochemical assay of Vitamin A and related compounds, bioassay of Vitamin A compounds, conversion of β-carotene into Vitamin A, absorption, transport, and storage of Vitamin A, metabolic transformations of Vitamin A, visual functions of the Vitamins A, Vitamin A and proteins, Vitamin A and mucopolysacchardie biosynthesis, function of Vitmain A in carbohydrate metabolism; its role in adrenocorticoid production, Vitamin A and lipid metabolism, pathology of Vitamin A deficiency, and role of Vitamin A acid. ***Robert S. Harris and Dwight J. Ingle, editors.*** v. XVIII. 615 pp. 1960. Academic Press, New York. (QP801.V5 V83)

*** The Supra- and Submolecular in Biology.** Discusses possible relationship between cell structure and soluble cell components in the stabilization, transportation and transformation of energy in living matter. ***Albert Szent-Györgyi.*** *Journal of Theoretical Biology*, v. 1, no. 1, Jan. 1961, p. 75-82.

*** Principles Concerning Primary Protein Structures.** Comparing the primary structures of closely related polypeptides or proteins it is found that the interchange of certain amino acids seems to be favored. (*In German.*) Über Prinzipien primärer Proteinstrukturen. ***Heinz Gibian.*** *Zeitschrift für Naturforschung*, v. 16b, Jan. 1961, p. 18-28.

*** The Photoelectric Sensitivity of Crystalline Chlorophyll and Green Leaf Pigments.** Determining the sign of the carriers of the photoelectric current revealed that, as in the case of the chlorophyll, in the layers obtained from extracted pigments of a leaf containing lipoids in the region of the two maxima of the photoelectromotive forces 720 and 420 mμ the carriers are positively charged. (*In Russian.*) Fotoelektricheskaia chuvstvitel'nost' kristallicheskogo khlorofilla i pigmentov zelenogo lista. ***E. K. Putseĭko and A. N. Terenin.*** *Akademiia Nauk SSSR, Doklady*, v. 136, no. 5, Feb. 1961, p. 1223-1226.

*** On the Mode of Radio-Protective Action in Dithiole.** An investigation of the protective effects of dimercapto compounds: unithiole and dimercaptopropionic acid. The radio-protective efficiency of dithiole, unlike the most active S-containing compounds (mercaptoethylamines or 2-aminoethylisouroniums-Br-HBr, etc), seems to depend on the hypoxia caused by them in the radio-sensitive organs. The mechanism inducing the hypoxia, when unithiole and dimercaptopropionic acid are introduced, is not explained. (*In Russian.*) O mekhanizme protivoluchevogo zashchitnogo deĭstviia ditiolov. ***E. Ia. Graevskiĭ and M. M. Konstantinova.*** *Akademiia Nauk SSSR, Doklady*, v. 136, no. 5, Feb. 1961, p. 1219-1222.

*** A Contribution to the Mutation Theory.** On the basis of the thermodynamic theory of the DNA reduplication, the authors calculated the thermodynamic probabilities for mutations of different types to appear. These probabilities increase exponentially with the increase of temperature. The influence of the quantum may consist in the increase of the local temperature at a given point in the DNA as a result of the transformation of the quantum energy into atomic vibration energy. (*In Russian.*) K teorii mutatsiĭ. ***M. V. Vol'kenshteĭn and A. M. El'iasherich.*** *Akademiia Nauk SSSR, Doklady*, v. 136, no. 5, Feb. 1961, p. 1216-1218.

*** Radiation-Protection by Some Sulphydryl Derivatives of Pyridoxine and a New BAL Preparation.** ***B. A. Bridges and R. Koch.*** *International Journal of Radiation Biology*, v. 3, no. 1, Jan. 1961, p. 49-58.

The Possibility of Therapeutic Applications of Beams of Negative π-Mesons. Describes the potential advantages of such beams over equivalent gamma ray beams in irradiating tumors. ***P. H. Fowler and D. H. Perkins.*** *Nature*, v. 189, Feb. 18, 1961, p. 524-528.

Net Synthesis of Ribonucleic Acid With a Microbial Enzyme Requiring Deoxyribonucleic Acid and Four Ribonucleoside Triphosphates. ***Samuel B. Weiss and Tokumasa Nakamoto.*** *Journal of Biological Chemistry*, v. 236, no. 3, Mar. 1961, p. PC18-PC20.

*** Symposium on Microstructure of Proteins.** Presented at the 138th National Meeting of the American Chemical Society, New York City, Sept. 14, 1960. Contains papers and edited discussion on methods of determining sequence of amino acids in proteins, the influences of 3-dimensional configuration on protein reactivity and stability, synthesis and structure of protein, neighboring groups and side chains in chymotrypsin, and phase changes in protein and polypeptides. *Journal of Polymer Science*, v. 49, Jan. 1961, 175 pp.

*** A Study of the Penetration of Mammalian Cells by Deoxyribonucleic Acids.** Tritium-labeled deoxyribonucleic acid (DNA) from pneumococci and from human leukocytes was taken up by nuclear portions of HeLa cells. The label could not be removed by treatment with ribonuclease or dilute perchloric acid, but quantitative removal from the cells could be effected with deoxyribonuclease. The amount of DNA, or its degradation products, taken up by the cells was equivalent to at least 10% of the normal HeLa cell complement. ***Ellen Borenfreund and Aaron Bendich.*** *Journal of Biophysical and Biochemical Cytology*, v. 9, no. 1, Jan. 1961, p. 81-91.

*** On Interaction Between the Nucleolus and Chromosomes.** (*In Russian.*) O vzaimodeĭstvii iadryshka i khromosom. ***I. I. Kiknadze.*** *TSitologiia*, v. 3, no. 1, Jan.-Feb. 1961, p. 3-19.

Cold Spring Harbor Symposia on Quantitative Biology. Biological Clocks. v. XXV. 524 pp. 1961. The Biological Laboratory, Cold Spring Harbor, New York. (QH301 C67s Vis.)

Advances in Protein Chemistry. ***C. B. Anfinsen, Jr., M. L. Anson, Kenneth Bailey, and John T. Edsall, editors.*** v. XV. 447 pp. 1960. Academic Press, New York. (QD431 Ad95 Vis.)

Recent Research in Freezing and Drying. Biophysics of freezing, freezing of living organisms, biophysics of freeze-drying, applications of freeze-drying to micro-organisms, and mammalian tissues. ***A. S. Parkes and Audrey U. Smith, editors.*** 320 pp. 1960. Charles C. Thomas, Springfield, Ill. (QH324 In8r)

On the Topography of the Genetic Fine Structure. ***Seymour Benzer.*** *National Academy of Sciences, Proceedings*, v. 47, Mar. 1961, p. 403-415.

A Bacteriophage Containing RNA. ***Tim Loeb and Norton D. Zinder.*** *National Academy of Sciences, Proceedings*, v. 47, Mar. 1961, p. 282-289.

*** Antigenicity of Pooled Human Malignant and Normal Tissues by Cytoimmunological Technique. III. Distribution of Tumor Antigen.** Human carcinomas and atypical cells of established tissue-culture lines possessed a common antigen which was pertinent for the initiation of cytotoxic manifestations

with the exposure *in vitro* of atypical cells to a horse antiserum. This antigen presumably constitutes a part of the plasma membrane. ***Bertil Björklund, Viveka Björklund, and Ingegerd Hedlöf.*** *U. S. National Cancer Institute, Journal,* v. 26, no. 3, Mar. 1961, p. 533-545.

*** The Radioprotective Action of Dimethyl Sulphoxide and Various Other Sulphoxides.** The dose-reduction factor for dimethyl sulphoxide was found to be 1.33, as compared with 1.45 for A.E.T. ***M. J. Ashwood-Smith.*** *International Journal of Radiation Biology,* v. 3, no. 1, Jan. 1961, p. 42-48.

*** Studies of Mechanisms of Chemical Radiation Protection *in vivo*. I. 5-Hydroxytryptamine in Relation to Effect of Antimetabolites, Antagonists and Releasing Agents.** The results given favor a simple exposition of 5-hydroxytryptamine protection in terms of pharmacologically-induced tissue anoxia and a reduction in the "oxygen effect". ***H. A. S. van den Brenk and Magda Haas.*** *International Journal of Radiation Biology,* v. 3, no. 1, Jan. 1961, p. 73-94.

*** Antigenic Activity of Various Tissues in Transplantation Immunity.** Various donor tissues differed greatly in ability to induce transplantation immunity. Skin grafts, epidermal cells, and renal epithelial cells were antigenically effective. Lymphoid cells injected intraperitoneally failed to induce immunity. It was concluded that the tissues studied may contain identical complements of transplantation antigens and that the basis of the different abilities of the various tissues to induce immunity may reside in the location of antigens within the cells, and in the interaction between grafted cells and the host. ***Charles F. McKhann and James H. Berrian.*** *Journal of Immunology,* v. 86, no. 3, Mar. 1961, p. 345-353.

*** Investigations on the Properties of Antibodies.** A review. (*In German.*) Untersuchungen über die Natur der Antikörper. ***F. Haurowitz.*** *Angewandte Chemie,* v. 73, no. 5, Mar. 1961, p. 153-160.

*** Transfer of DNA From Parent to Progeny in a Tissue Culture Line of Human Carcinoma of the Cervix (Strain HeLa).** Results are consistent with a semiconservative mechanism of DNA replication. ***Edward H. Simon.*** *Journal of Molecular Biology,* v. 3, no. 1, Feb. 1961, p. 101-109.

*** The Theory of Mutagenesis.** The authors propose that acridines act as mutagens because they cause the insertion or the deletion of a base-pair. ***S. Brenner, Leslie Barnett, F. H. C. Crick, and Alice Orgel.*** *Journal of Molecular Biology,* v. 3, no. 1, Feb. 1961, p. 121-124.

Comparative Effects of Radiation. Report of a Conference held in San Juan at the University of Puerto Rico, Feb. 15-19, 1960, sponsored by National Academy of Sciences—National Research Council. ***Milton Burton, J. S. Kirby-Smith, and John L. Magee, editors.*** 426 pp. 1960. John Wiley & Sons, New York. (QC475 B95c)

*** Resistance of Polyoma Virus Immunized Mice to Transplantation of Established Polyoma Tumors.** Twelve of 13 polyoma-induced tumors tested with the minimum cell dose did not grow at all in virus-immunized recipients or grew only occasionally. Virus-immunized animals also showed a variable degree of resistance against concentrated cell suspensions. With 10 of 14 tested tumors, resistance was clearly indicated by outgrowth followed by regression. Control tests with five spontaneous mammary carcinomas and one methylcholanthrene-induced sarcoma showed no difference with regard to the susceptibility of virus-immunized mice and untreated controls to the minimum cell dose. ***H. O. Sjögren, Ingegerd Hellström, and G. Klein.*** *Experimental Cell Research,* v. 23, no. 1, Feb. 1961, p. 204-208.

*** The Stabilization of *Bacillus subtilis* Transforming Principle by Spermine.** ***Herbert Tabor.*** *Biochemical and Biophysical Research Communications,* v. 4, no. 3, Mar. 1961, p. 228-231.

Mechanism of Collagen Synthesis. ***G. B. Gerber and K. I. Altman.*** *Nature,* v. 189, Mar. 11, 1961, p. 813-814.

Blood Nucleases and Infections Viral Nucleic Acids. ***Roger M. Herriott, John H. Connolly, and Shanta Gupta.*** *Nature,* v. 189, Mar. 11, 1961, p. 817-820.

Multi-Stranded Deoxyribonucleic Acid as Determined by X-Irradiation. DNA molecules from nonproliferating sources are double helices, whereas molecules from proliferating sources consist of linked pairs of double helices. ***Liebe F. Cavalieri, Roland Finston, and Barbara Hatch Rosenberg.*** *Nature,* v. 189, Mar. 11, 1961, p. 833-834.

*** A Tentative Transduction of Heterogeneous Deoxyribonucleic Acid to Chicks.** In reviewing experiments in Russia and abroad about the transformation in higher organisms, the discrepancies in the results are ascribed to the methods used in obtaining DNA, in separating it from protein and in storing it. In some cases the biological activity was lost. (*In Russian.*) Opyt vvedeniia chuzherodnoi DNK kuram. ***S. A. Bogatyreva, M. P. Znamenskaia, Kh. F. Kushner, I. G. Moiseeva, and E. V. Tolokonnikova.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 5, Feb. 1961, p. 1213-1215.

CERAMICS AND CONCRETE

*** Some Preparative Methods and Physical Characteristics of Uranium Dioxide Powders.** Studies were made to find relationships between method of preparation of UO_2 and its physical properties. Information was sought regarding the effects of chemical processes on microstructure, density, surface area, porosity, crystallite size, and particle-size distribution. ***J. C. Clayton and Seymour Aronson.*** *Journal of Chemical and Engineering Data,* v. 6, no. 1, Jan. 1961, p. 43-51.

*** Mechanism of Setting of Gypsum Plaster.** Includes data on calcium sulfate and its hydrates; the nature of gypsum plaster; theories of the setting of gypsum plaster; and the kinetics of setting. ***M. J. Ridge.*** *Reviews of Pure and Applied Chemistry,* v. 10, no. 4, Dec. 1960, p. 243-276.

*** Physical Methods for Investigating the Properties of Oxide Powders in Relation to Sintering.** By the application of several modern techniques, a fairly thorough characterization of even the finest oxide powders with respect to particle and crystallite size and shape may be obtained. The application of these techniques is discussed with particular reference to the characterization of a sample of $Mg(OH)_2$ and the oxides prepared from it by calcination *in vacuo*. ***P. J. Anderson and D. T. Livey.*** *Powder Metallurgy,* no. 7, 1961, p. 189-203.

A Boron-Base Refractory. A refractory composition produced by the magnesium-thermal reaction from a mixture of boric oxide, silica and magnesium conforms in many of its physical properties to those properties desired in refractory liners where temperatures up to 982 C under oxidizing conditions are found. It has a melting point above 1,700 C, low density <3.0 g/cc, is chemically inert to water and hydrogen, has good resistance to thermal shock, a low thermal expansion coefficient, and satisfactory hardness to resist gas erosion. ***Perry G. Cotter.*** *U. S. Bureau of Mines Report of Investigations* 5774, 1961, 7 pp. (TN21 Un3r Room 290)

Vaporization of Zirconium Oxide. The vaporization rate of zirconium oxide in the temperature range 2410 to 2830 K was measured using the Knudsen effusion technique, and the composition of the vapor was estimated from a mass spectrometric observation. These data were used, with pertinent thermodynamic quantities obtained from the literature, to calculate the dissociation energies D: $(ZrO) = 7.8 \pm 0.2$ ev, and D: $(ZrO_2) = 14.9 \pm 0.2$ ev. ***M. M. Nakata, R. L. McKisson, and B. D. Pollock.*** *U. S. Atomic Energy Commission, NAA-SR-6095,* Apr. 15, 1961, 10 pp. (UF767 Un3.1na Contin.)

*** General Developments in Ceramics for Marine Engineering.** Reviews developments during the last decade in marine boilers, gas turbines, diesel engines and nuclear power plants. The development of super duty bricks and moldable and castable materials used extensively in marine boilers is referred to and developments aimed to provide ceramic materials suitable for gas turbine combustion chamber linings and turbine blades are described. Mention is made of ceramic coatings for Diesel engine pistons and valves, and ceramic materials which may be employed in nuclear reactors are reviewed. ***F. H. Aldred and N. W. Hinchliffe.*** *Institute of Marine Engineers, Transactions,* v. 73, Mar. 1961, p. 81-97.

Ceramics—Thermal Conductivity. Lattice and electronic conductivity; macroscopic effects; ways of increasing thermal conductivity. ***G. Arthur.*** *Nuclear Engineering*, v. 6, Apr. 1961, p. 138-142.

* **A Method to Determine the Disruptive and Elastic Characteristics of Glass Films.** The method described permits the determination of the disruptive pressure and sagging of glass films around a circular contour, and the evaluation of these films by their mechanical properties. Films differing in thickness were tested for two types of glass. With decreasing thickness, the strength of the glass films increases starting from 100μ. (*In Russian.*) Metod opredeleniia razryvnoĭ i uprugoĭ kharakteristik stekliannykh plenok. ***I. I. Kitaigorodskii, V. V. Rostokinskii, and V. I. Elinek.*** *Steklo i Keramika*, v. 18, no. 3, Mar. 1961, p. 8-11.

Allis-Chalmers Markets Boron Silicides. Describes methods of manufacturing and processing of hexaboron and tetraboron silicides. The compounds can be fabricated by conventional powder metallurgical and ceramic methods. For instance, they can be hot pressed to give dense bodies. The powdered material can be slip cast. Firing in air or inert atmosphere yields bodies which are oxide-bonded, or self-bonded, respectively. When presintered at about 2000 F in air, the oxide-bonded compound is machinable. *Chemical & Engineering News*, v. 39, no. 17, Apr. 24, 1961, p. 64-65.

CHEMICAL ENGINEERING

Wipers in Saline Water Conversion. New distillation process eliminates boiling, said to raise heat-transfer rate markedly. *Chemical Engineering Progress*, v. 57, Mar. 1961, p. 94.

Hydrazine Production by Nuclear Reaction. Nuclear reactors, as chemical processing tools, are being investigated by a USAF-industry team interested in production of hydrazine, a promising liquid missile fuel. ***C. P. Fritsch, Jr., M. R. Gustavson, J. H. Cusack, and R. I. Miller.*** *Chemical Engineering Progress*, v. 57, Mar. 1961, p. 37-41.

* **Application of Frequency Curves to the Determination of the Efficiency of Separators.** The frequency curves in this method are plotted for trapped dust. The method can be applied advantageously to designs of very advanced separators which must trap extremely fine particles even in low concentrations. (*In Czech.*) Užití křivky četnosti k stanovení celkové odlučivosti. ***Z. Svoboda.*** *Strojírenství*, v. 11, no. 2, Feb. 1961, p. 116-118.

The Oxidation of Cyanide-Bearing Plating Wastes by Ozone. II. ***N. E. Sondak and B. F. Dodge.*** *Plating*, v. 48, Mar. 1961, p. 280-284.

Follow These Safety Rules for Designing, Operating Compressed Gas Piping Systems. ***Ellis L. Stout.*** *Heating, Piping & Air Conditioning*, v. 33, Mar. 1961, p. 100-103.

* **The Experimental Investigation of Heat and Mass Transfer in the Presence of Chemical Conversions.** Investigations on the process of kilning kaolin and magnesium hydroxide are adduced in this paper. An experimental installation was developed which allows the temperature field of the heated body, its mass loss and the thermophysical characteristics of the body to be determined. ***A. V. Ralko.*** *International Journal of Heat and Mass Transfer*, v. 1, no. 4, Jan. 1961, p. 273-279.

* **Design of a Small Industrial Wiped Wall, Falling Film Short Path Distillation Unit.** Unit is capable of throughputs close to the rated maximum of 100 kg per hour. It has operated for periods exceeding 24 hrs without attention, and control and maintenance have been consistently simple. ***J. S. Olejniczak and T. W. G. Rowe.*** *Vide*, v. 15, no. 90, Nov.-Dec. 1960, p. 469-480.

* **Sulphur Tetrafluoride—The Modern Selective Fluorination Agent.** (*In Polish.*) Czterofluorek siarki, nowoczesny selektywny cynnik fluorujący. ***Antoni Z. Zieliński.*** *Przemysł Chemiczny*, v. 39, no. 12, Dec. 1960, p. 747-749.

Wiper-Blade Heat Exchanger. From 100 lb. of brine, 42 lb. of fresh water from thin water films. *Machine Design*, v. 33, Mar. 2, 1961, p. 32.

Coalescence and Dispersion Rates in Agitated Liquid-Liquid Systems. Aims at determining the variables affecting the coalescence of droplets after they leave the impeller tip. ***James Hidde Vanderveen.*** *U. S. Atomic Energy Commission, UCRL-8733*, Dec. 1960, 56 pp. (UF767 U3u Contin.)

* **Evaporation.** Reviews the more important developments in evaporation during the last three years. ***P. J. King.*** *Chemical & Process Engineering*, v. 42, Feb. 1961, p. 75 + 5 pages.

* **Carbohydrates in the Chemical Industry. II. Starch, Cellulose and Derivatives.** Describes the chemistry of starch and cellulose. Concludes with a section on alginic acid and pectin, which are finding increasing use in pharmaceuticals, cosmetics and food products. ***Greville Machell.*** *Manufacturing Chemist*, v. 32, Feb. 1961, p. 57-60.

* **On the Basic Principles of Process Equipment Design.** Considers the method of establishing the relation among the physical quantities on the basis of an equation having the form common to many phenomena. ***N. I. Taganov.*** *Journal of Scientific & Industrial Research*, v. 19A, Dec. 1960, p. 603-607.

Research on the Hazards Associated With the Production and Handling of Liquid Hydrogen. The vaporization of liquid H from a surface is treated as a problem in heat transfer theory. Two extremes are considered: the transfer of heat occurs at constant temperature drop between the boiling liquid and the hot surface, and the transfer of heat is limited by the rate at which it can flow to the surface from a hot insulating medium. ***M. G. Zabetakis and D. S. Burgess.*** *U. S. Bureau of Mines Report of Investigations* 5707, 1961, 50 pp. (TN21 Un3r Room 290)

Process Maze Yields Maize Products. Plant features both modernness and diversity as it turns out a broad line of industrial products from raw-material corn. ***T. P. Forbath.*** *Chemical Enigneering*, v. 68, Mar. 6, 1961, p. 90-93.

* **Investigation of the Possibility of Repeated Application of a Part of the Wash Water in Salt-Eliminating Installations.** During washing after regenerating the cationated filter by the wash waters of a previous cycle, containing 2.56% HNO_3 and 0.92% NH_2NO_3, the working capacity of absorption of the cationite KU-2 is not decreased as compared with the working capacity of absorption of this cationite when washing it only with distilled water. When the wash waters of the previous cycle contain 0.8% free ammonia and 0.76% ammonium nitrate, the working capacity of absorption of the anionite AN-2F is not decreased as compared with the working capacity of absorption of this anionite when washing it only with distilled water. (*In Russian.*) Issledovanie vozmozhnosti povtornogo primeneniia chasti promyvnykh vod v obessolivaiushchikh ustanovkakh ***V. I. Atroshchenko, Ia. I. Asnin, and Z. A. Nikitskaia.*** *Khimicheskaia Promyshlennost'*, 1961, no. 1, Jan., p. 66-68.

Monographs on the Physics and Chemistry of Materials. Molecular Distillation. Attempts to bring together the various aspects of the subject. Engineering problems associated with the production and maintenance of the necessary degree of vacuum are given attention, while the special features of gas and vapor flow at low pressures receive detailed treatment. ***G. Burrows.*** 214 pp. 1960. Oxford University Press, London. (TP156.D5 B94m)

* **Effect of Particle Size Distribution in Fluidisation. II. Classification and Elutriation.** A special probe enables multiple samples to be taken from the bed. Shows that classification within the bed occurs with an accumulation of fines in a zone near the surface. This zone restricts the elutriation of the fines from the bed. ***W. J. Thomas, P. J. Grey, and S. B. Watkins.*** *British Chemical Engineering*, v. 6, Mar. 1961, p. 176-181.

Filter Aids Speed Up "Difficult" Filtrations. Background for selecting the proper type and grade of filter aid. ***Thomas M. Jackson, Jr.*** *Chemical Engineering*, v. 68, Mar. 20, 1961, p. 141-146.

Evaluate Heat Exchanger Coefficients. Where a heat exchanger is the limiting factor in the capacity of a process unit, a method that corrects measured heat-transfer coefficients to

standard flow rates permits close monitoring of the coefficient to give the optimum cleaning cycle for any type of heat exchanger. ***Joseph F. Frantz.*** *Chemical Engineering*, v. 68, Mar. 20, 1961, p. 151-154.

Graphical Prediction of Ternary Azeotropes. By straightforward calculation and graphing, this method gives values in good agreement with literature values. ***Paul J. Horvath.*** *Chemical Engineering*, v. 68, Mar. 20, 1961, p. 159 + 4 pages.

* **The Graphical Design of Bubble-Cap Trays.** The "equivalent diameter" concept and its application to the design of bubble-cap trays is described. By means of this concept, analysis of the bubble-cap tray sizing can be effected by means of three diagrams, while four other diagrams are available for carrying out the conventional hydraulic analysis rapidly. ***L. S. Gyökhegyi and J. J. Czermann.*** *British Chemical Engineering*, v. 6, Mar. 1961, p. 158-167.

Removing Acid Gas by Agitated Absorption. Developing a compact, agitated, gas-liquid contactor for use with concentrated absorbents; comparison of the agitated contactor with conventional scrubbers in terms of mass-transfer coefficients. ***A. S. Moore and C. C. Shale.*** *U. S. Bureau of Mines Report of Investigations* 5730, 1961, 26 pp. (TN21 Un3r Room 290)

* **The Treatment of Sewage Containing Synthetic Detergents.** Describes systematic tests, carried out first on the laboratory scale, then in pilot plants. These tests led to the "Luton Experiment", a two-year study on the sewage from the town of Luton, discharged into the river Lee. (*In French.*) Le traitement des eaux d'égout contenant des détergents synthétiques. *Chimie & Industrie*, v. 85, no. 2, Feb. 1961, p. 246-251.

* **The Fractionation of Gaseous Mixtures by Adsorption.** Application to the production of overoxygenated air at ordinary temperature. (*In French.*) Fractionnement des mélanges gazeux par adsorption. ***Pierre Guérin de Montgareuil and Daniel Dominé.*** *Chimie & Industrie (Génie Chimique)*, v. 85, no. 2, Feb. 1961, p. 37-49.

* **Proceedings of the Second European Symposium on Chemical Reaction Engineering, Amsterdam, April 26-28, 1960.** Contains some 30 papers from the above symposium covering selectivity and optimization, reactions involving contact between gas and liquid and between two liquids, distribution of residence time, mathematical techniques and models, and reactions involving contact between fluid and solid. *Chemical Engineering Science*, v. 14, Jan. 1961, 396 pp.

* **Calculating Dimensions of Thick-Walled Tubes Operating Under Loads at Elevated Temperatures.** Method enables designers of pipelines and high pressure vessels to save material without sacrificing the reliability of installations. (*In Czech.*) Dimenzování tlustostěnných trubek namáhaných za vysokých teplot. ***N. Gorbatov.*** *Strojírenství*, v. 11, no. 1, Jan. 1961, p. 4-12.

Pressure and Thermal Stresses at a Pipe Attachment to a Sphere. Nomographs and equations for determining the bending stresses and hoop stresses at the junction of a cylinder and sphere. ***L. Deagle.*** *U. S. Atomic Energy Commission, KAPL-2109*, Sept. 21, 1959, 18 pp. (UF767 Un3.1ka Contin.)

Recovery of Uranium From Amine Extractions With Ammonium Carbonate. By recycling the strip solution to allow buildup in the concentration of ammonium sulfate (formed in the stripping reactions) to 1-2 *M*, the solubility of U in the aqueous phase was limited to <5 g/liter and ammonium uranyl tricarbonate precipitated in the stripping system. ***F. J. Hurst and D. J. Crouse.*** *U. S. Atomic Energy Commission, ORNL-3064*, Mar. 1, 1961, 22 pp. (UF767 U3o Contin.)

Catalytic Reactor Design. A simplified kinetic scheme for the catalytic oxidation of naphthalene to phthalic anhydride is combined with the appropriate transport equations to yield a description of over-all fluid bed reactor performance. ***F. DeMaria, J. E. Longfield, and G. Butler.*** *Industrial and Engineering Chemistry*, v. 53, Apr. 1961, p. 259-266.

* **About the Heat Conductivity of Insulation Materials.** The heat conductivity of highly efficient solid and pulverized heat insulations mainly depends on the heat conduction within the gas spaces of the insulating material. Due to the smallness of these gas spaces the heat conductivity may be lower than that of the pure gas at rest. (*In German.*) Über die Wärmeleitzahl von Isolierstoffen. ***Th. E. Schmidt.*** *Forschung auf dem Gebiete des Ingenieurwesens* (Ausgabe B), v. 27, no. 1, 1961, p. 10-14.

* **The High Temperature Pyrolysis of Acetylene, 1400° to 2500°K.** The pyrolysis of C_2H_2-Ar mixtures has been investigated using shock wave heating. ***C. F. Aten and E. F. Greene.*** *Combustion and Flame*, v. 5, no. 1, Mar. 1961, p. 55-64.

* **Carbon Disulphide From Hydrocarbons.** Highlights advantages of the Thacker Process. *Sulphur*, no. 32, Feb. 1961, p. 28-32.

Boundary-Layer Behavior on Continuous Solid Surfaces: I. Boundary-Layer Equations for Two-Dimensional and Axisymmetric Flow. ***B. C. Sakiadis.*** *A.I.Ch.E. Journal*, v. 7, no. 1, Mar. 1961, p. 26-28.

Diffusion Rates in Porous Catalysts. Rates of He, N, and CO_2 flow through alumina pellets were measured at atmospheric pressure and room temperature. Results showed that Knudsen type of diffusion was the controlling transport process despite the large fraction of void volume in the macropores. ***J. P. Henry, Balapa Chennakesavan, and J. M. Smith.*** *A.I.Ch.E. Journal*, v. 7, no. 1, Mar. 1961, p. 10-12.

A Method of Measuring Thermal Diffusivities of Rocks at Elevated Temperatures. ***W. H. Somerton and G. D. Boozer.*** *A.I.Ch.E. Journal*, v. 7, no. 1, Mar. 1961, p. 87-90.

* **Laws of Turbulent Gas Diffusion as a Foundation for the Determination of Minimum Chimney Elevations.** Methods to evaluate this minimum height are necessarily based on the laws of turbulent gas diffusion and governed by a series of meteorological parameters. (*In German.*) Gesetze der Gasausbreitung als Grundlage zum Bestimen der Schornsteinmindesthöhen. ***Julius Drimmel, et al.*** *Forschung auf dem Gebiete des Ingenieurwesens* (Ausgabe B), v. 27; *VDI-Forschungsheft* 483, 1961, 52 pp.

CHEMISTRY—ANALYTICAL

* **A New Method to Build the Pyrrole System.** N-alkyl, N-aryl or N-acyl amines with two CH_2 groups activated by carboxylic acid ester groups or nitril groups in the α,α' position can be condensed with benzil in the presence of potassium-tertiary butylate with yields of up to 60-80% into 1 alkyl (aryl or acyl)-3,4-diphenyl-pyrrole-derivatives, which in the two or five position carry carboxy, carbalkoxy, cyan or carboxylic acid amide rests. (*In German.*) Ein neuer Weg zum Aufbau des Pyrrol-Ringsystems. ***Karl Dimroth and Ulrich Pintschovius.*** *Annalen der Chemie (Justus Liebigs)*, v. 639, nos. 1-3, Jan. 1961, p. 102-124.

* **Spot Test for Ruthenium(3) and *p*-Phenylenediamine.** *Para*-phenylenediamine gives a spot test for ruthenium(3). Conversely, ruthenium(3) may be used for the detection of *p*-phenylenediamine. The test for *p*-phenylenediamine is very sensitive and almost specific. ***Anil K. Mukherji.*** *Mikrochimica Acta*, 1961, no. 1, p. 1-4.

* **Studies in Qualitative Inorganic Analysis. XVII. Detection of Chromate and Dichromate in the Presence of Each Other.** Sensitivity of the tests is increased if the solutions are evaporated to dryness, when it is shown that chromate can be detected in mixtures of 1:50 chromate:dichromate, and dichromate can be detected in 1:33 dichromate:chromate. ***W. F. Jones.*** *Mikrochimica Acta*, 1961, no. 1, p. 88-91.

* **Resolution of Some Protein Mixtures by Gradient Elution Paper Chromatography.** Demonstrates new possibilities in the paper chromatography of proteins by forming a controlled concentrations gradient of salt solutions along the paper strip, as applied to the protein mixtures of insulin-protamine and egg albuminlysozyme. Some experimental results on the influence of cations and anions on the elution of proteins in paper chromatography are presented. ***A. Meniga and N. Muić.*** *Analytical Biochemistry*, v. 1, no. 6, Dec. 1960, p. 502-510.

*** Titrimetric Methods for the Microdetermination of Halogens in Organic Compounds by the Rapid Combustion Procedure. I. The Determination of Individual Halogens.** Methods suitable for the microdetermination of each of the halogens, chlorine, bromine and iodine, in their possible organic combinations with the elements, O, N, and S, following organic decomposition by the rapid empty tube combustion procedure. ***J. E. Fildes and A. M. G. Macdonald.*** *Analytica Chimica Acta*, v. 24, no. 2, Feb. 1961, p. 121-127.

*** The Rapid Spectrophotometric Determination of Copper in Non-Ferrous Alloys.** Method employing the formation of the chlorocupric anion by means of concentrated hydrochloric acid. The absorption of the chlorocupric anion is measured spectrophotometrically at a wavelength of 950 mμ. ***G. Lindley.*** *Analytica Chemica Acta*, v. 24, no. 2, Feb. 1961, p. 161-166.

*** Colorimetric Determination of Vanadium as Vanadyl Sulphate.** Blue color of vanadyl sulfate used as the basis of colorimetric determination of V. In the concentration range from 0.05 to 0.7 mg V/cc, the solution obeyed the Beer Law. In the determination Cr, Co, and Ti, Fe, Mn, Ni, Mo, W, Pb, and colorless ions do not interfere. Method can be used as a rapid method of V determination in H_2SO_4. (*In Polish.*) Kolorymetryczne oznaczanie wanadu w postaci siarczanu wanadylu. ***Maksymilian Kranz and Jarosław Krzyżaniak.*** *Chemia Analityczna*, v. 5, no. 2, 1960, p. 243-246.

*** N,N′-di-(2-Hydroxy-5-sulphophenyl)-C-cyanformazan as a Reagent for the Photometric Determination of Gallium.** A method for the synthesis of N,N′-di-(2-hydroxy-5-sulphophenyl)-C-cyanformazan described. It has been shown that N,N′di-(2-hydroxy-5-sulphophenyl)-C-cyanformazan permits the determination of Ga in Al and Zn at the ratios of Ga : Al = 1 : 50,000 and Ga : Zn = 1 : 5000. (*In Russian.*) N,N′-di-(2-oksi-5-syl'fofenil)-s-tsianformazan kak reagent dlia folometricheskogo opredeleniia galliia. ***M. I. Ermakova, N. L. Vasil'eva and I. Ia. Postovskiĭ.*** *Zhurnal Analiticheskoĭ Khimii*, v. 16, no. 1, Jan.-Feb. 1961, p. 8-13.

*** Determination of Copper and Manganese Content in Ores by Neutron Radioactivation Analysis.** The direct determination of 0.03-0.9% of Cu and 0.028-0.3% of Mn is possible with the use of a γ-ray scintillation spectrometer for recording the γ-ray radiation of activated rock samples at the neutron flux about 10^7 neutron/cm^{-2}·sec^{-1}. The possible experimental error is ±5-8%. (*In Russian.*) Opredelenie soderzhaniia medii margantsa v rudakh metodom neĭtronnogo radioaktivatsionnogo analiza. ***E. M. Lobanov, O. M. Romanov, M. M. Romanov, and A. A. Khaidarov.*** *Zhurnal Analiticheskoĭ Khimii*, v. 16, no. 1, Jan.-Feb. 1961, p. 25-28.

*** Element-Organic Analysis by the "Wet Combustion" Method. II. Rapid Determination of Silicon in Organic Silicon Compounds.** A rapid method for the determination of Si in organic silicon compounds is based on their oxidation by a mixture of chromic and sulfuric acids at 150°. The resulted silica is filtered off, dissolved in an alkali, converted to a fluosilicate ion in the presence of an acid; the excess acid is titrated with an alkali. The determination takes 1.5 hr. The determination of Si in compounds readily hydrolyzable with an aqueous alkali solution with the formation of silica takes 30 min. (*In Russian.*) Elementarno-organicheskiĭ analiz metodom "Mokrogo sozhzheniia." Soobshchenie. II. Uskorennoe opredelenie kremniia v kremniĭorganicheskikh soedineniiakh. ***A. P. Terent'ev, S. V. Siavtsillo, and B. M. Luskina.*** *Zhurnal Analiticheskoĭ Khimii*, v. 16, no. 1, Jan.-Feb. 1961, p. 83-86.

*** Photometric Determination of Low Copper Contents in Iron and Steel With Bis-Cyclohexanone-Oxalyldihydrazone (BCO).** A method for the photometrical determination of Cu contents between 0.001 and 0.2% in Fe and steel was described. Fe is separated by ammonia precipitation and Cu is photometrically determined in the filtrate. For contents between 0.01 and 0.2% Cu, the standard discrepancy is (s)± 0.001_2% Cu and the variance (V) 1.7%; between 0.001 and 0.02% Cu, s is ± 0.001_5% Cu and V is 2.3%. A determination is obtained in 30 minutes. (*In German.*) Photometrische Bestimmung kleiner Kupfergehalte in Eisen und Stahl mit Bis-cyclohexanon-oxalyldihydrazon (BCO). ***Siegfried Meyer and Othmar G. Koch.*** *Archiv für das Eisenhüttenwesen*, v. 32, no. 2, Feb. 1961, p. 67-70.

*** Photometric Determination and Separation of Ruthenium by Acetyl Acetone.** By means of an acetyl acetone solution in chloroform, the accompanying cations react practically instantaneously in acid solution and in the cold are extracted. After proper adjustment of the pH and heat, the ruthenium acetyl acetonate is formed and photometrically determined. (*In German.*) Photometrische Bestimmung und Trennung des Rutheniums Mittels Acetylacetons. ***J. Brandštetr and J. Vřešlál.*** *Collection of Czechoslovak Chemical Communications*, v. 26, no. 2, Feb. 1961, p. 392-397.

*** Determination of Tungsten in Association With Iron and Some Other Elements as Tris(Tri-*n*-Butylammonium)12-Tungstophosphate. *C. C. Miller and D. H. Thow.*** *Talanta*, v. 8, no. 1, Jan. 1961, p. 43-51.

Treatise on Analytical Chemistry. Pt. II. Analytical Chemistry of the Elements. Systematic Analytical Chemistry of the Elements: Cd, Cu, Mg, Hg, Sn, and Zn. ***I. M. Kolthoff, Philip J. Elving, and Ernest B. Sandell, editors.*** v. III. 380 pp. 1961. Interscience Publishers, New York. (QD75 K83t)

*** Proceedings of the Radioactivation Analysis Symposium.** Radioactivation analysis is applied to biology, biochemistry, geology and chemistry. These fields have much to gain by its use, since it enhances the accuracy of analytical methods, and, in many cases, with its help much smaller amounts can be determined than had been possible hitherto by using conventional methods. *Pure and Applied Chemistry*, v. 1, no. 1, 1960, 186 pp.

Advances in Analytical Chemistry and Instrumentation. Tetraphenylboron (TPB) as an analytical reagent, advances in gas chromatography detectors, trends in the determination of fluorine, organic microanalysis, theory of electrode processes, analytical chemistry of thioacetamide, and near-infrared spectrophotometry. ***Charles N. Reilley, editor.*** v. I. 445 pp. 1960. Interscience Publishers, New York. (QD71 Ad95 Vis.)

*** Use of Selenurea in Analysis. II. Photometric Determination of Ruthenium and Osmium Without Separation by Means of Selenurea. The Composition and Stability of the Ruthenium-Selenurea Complex.** The composition and stability of a ruthenium-selenurea complex have been studied. It has been shown that selenurea forms a colored compound with ruthenium exhibiting maximum absorbance at 760 mμ and having the component ratio (Ru^{++}):R = 1:3. A method has been developed for the determination of ruthenium and osmium without separation. The method gives determination from 2 to 60 γ/ml Ru and equal amounts of Os in the presence of all platinum metals; large quantities of palladium are an exception. (*In Russian.*) Primenenie selenomocheviny v analize. Soobshchenie. 2. Fotometricheskoe opredelenie ruteniia i osmiia pri pomoshchi selenomocheviny bez ikh razdeleniia. Sostav i prochnost' selenomochevinnogo kompleksa ruteniia. ***A. T. Pilipenko and I. P. Sereda.*** *Zhurnal Analiticheskoĭ Khimii*, v. 16, no. 1, Jan.-Feb. 1961, p. 73-78.

CHEMISTRY—INORGANIC AND GENERAL

*** The Thermal Hyrolysis of Metal Chlorides. II. Cobaltous Chloride and Manganous Chloride.** Thermal hydrolysis in the temperature range 400-500 C, proceeds, after a short induction period, in a linear rate up to 80-85% of the chlorine content of the samples. In both cases the solid product is the simple oxide MO. ***A. Glasner and I. Mayer.*** *Research Council of Israel, Bulletin*, v. 9A, nos. 3-4, Nov. 1960, p. 161-172.

*** The Isotope Exchange of Hydrogen in Primary and Secondary Alkyl Chlorides.** These chlorides greatly accelerate the H exchange with DCl in a nitrobenzene solution in the presence of aprotic acids $SbCl_5$, $FeCl_3$, $AlCl_3$. In the presence of BF_3 and $SnCl_4$ the H exchange is much slower. Under equal conditions corrosive sublimate does not initiate the H exchange of these chlorides. The H exchange of alkyl chlorides depends on the heterolysis of the C-Cl bond and the formation of certain ions. (*In Russian.*) Ob izotopnom obmene vodoroda v pervichnykh i vtorichnykh alkilkhloridakh. ***V. N. Setkina and D. N.***

Kursanov. Akademiia Nauk SSSR, Doklady, v. 136, no. 6, Feb. 1961, p. 1345-1348.

* **Study of Peroxide Complexes of Titanium.** The equilibrium between a peroxide Ti complex solution formed in an alkali medium and the deposit of Ti hydroxide with pH between 10 and 14 was studied. The equilibrium depends only slightly on the pH of the solution, which is possible only if the links under these conditions are O_2 ions. At pH between 10 and 13 a peroxide complex is formed in which the Ti:H_2O_2 ratio is 1:1; at pH=14 a complex with Ti:H_2O_2=1:2 is formed. The two complexions are negatively charged. (*In Russian.*) Izuchenie perekisnykh komplekxov titana. ***A. K. Babko and N. V. Ul'ko.*** *Ukrainskiĭ Khimicheskiĭ Zhurnal,* v. 27, no. 1, 1961, p. 101-106.

* **The New Compounds Molybdenum and Tungsten Borides MoB_4 and WB_4.** The two borides prepared and identified were of the same MB_4 type quadratic and isomorphous. These compounds are obtained by the union of two simple bodies. A high B excess permits the total combination of Mo and W at 1400 C. They are entirely dissociated at 1600 C with liberation of B and formation of M_2B_5. The reversed reaction occurs between 1100 and 1400 C. (*In French.*) Sur les borures de molybdène et de tungstène MoB_4 et WB_4, composès nouveaux. ***André Chrétien and Jacques Helgorsky.*** *Comptes Rendus Hebdomadaires des Seances de l'Acadèmie des Sciences,* v. 252, no. 5, Jan. 30, 1961, p. 742-744.

* **Preparation and Formation of Zinc-Chromium Catalysts for the Synthesis of Alcohols.** The composition of nonreduced Zn-Cr catalysts has the following formula: $ZnO \cdot ZnCrO_4 \cdot H_2O$. The water of crystallization is connected with zinc chromate and is eliminated at 250 C. During the formation of the catalyst in H, zinc chromate is reduced with formation of zinc chromite and zinc oxide. The water of crystallization is also eliminated during these processes which takes place between 190 and 210 C. (*In Russian.*) Prigotovlenie i formirovanie tsink-khromovykh katalizatorov sinteza spirtov. ***V. M. Vlasenko, B. I. Kruglov, M. G. Rozenfel'd, and M. T. Rusov.*** *Khimicheskaia Promyshlennost',* 1961, no. 1, Jan., p. 1-6.

* **Interaction of Disiloxane With Boron Trifluoride and Trichloride.** Disiloxane does not form stable adducts with boron trifluoride and trichloride, but cleavage of an Si-O bond occurs with formation of the corresponding monohalogenosilane and siloxy-boron dihalide. Disilthian does not react with boron trifluoride. ***M. Onyszchuk.*** *Canadian Journal of Chemistry,* v. 39, Apr. 1961, p. 808-814.

* **The Condition of Hexavalent Uranium and Pentavalent Vanadium in Aqueous-Ammonium Solutions.** On the basis of the results of a study of the dependency of the values of light absorption in the V_2O_5-H_2SO_4(NH_4OH)-H_2O system on the $\frac{H+}{V_2O_5}$ or $\frac{OH}{V_2O_5}$ relationship, the assumption of the existence in aqueous V solutions of the following ions was demonstrated: $[VO(SO_4)_2]^-$ or $[VO(SO_4)_3]^{3-}$, VO^{3+}, VO_2^+, VO_3^- and $V_2O_7^{4-}$. The study of the UO_2SO_4-NH_4OH–H_2O system, done by measuring the light absorption, the pH and the solubility, showed the formation of the following compounds: $3UO_3(OH)_2 \cdot 5UO_2SO_4$, $H_2U_2O_7$, $NH_4HU_2O_7$ and $(NH_4)_2U_2O_7$. (*In Russian.*) O sostoianii shestivalentnogo urana i piativalentnogo vanadiia v vodno-ammiachnykh rastvorakh. ***V. L. Zolotavin, I. Ia. Bezrukov and Iu. I. Sannikov.*** *Zhurnal Neorganicheskoĭ Khimii,* v. 6, no. 3, Mar. 1961, p. 581-586.

* **Determination of the Solubility of Zirconium.** The pH at the beginning of an intensive dissolving process of zirconium hydroxide was found to be 1.80. This process occurs at this pH interval and higher. The activity of $Zr(OH)_4$ at 19 C is equal to 1.1×10^{-54}. The influence of the ion force of a sodium nitrate solution on the pH at the beginning of the solving process of the hydrate of zirconium oxide and on its solubility with a constant pH of the solution was studied. (*In Russian.*) Opredelenie rastvorimosti gidrookisi tsirkoniia. ***P. N. Kovalenko and K. N. Bagdasarov.*** *Zhurnal Neorganicheskoĭ Khimii,* v. 6, no. 3, Mar. 1961, p. 534-538.

Rare-Earth Elements. Utilization, geochemistry, variations in specific gravity, separation, isolation, and preparation of rare earth elements. ***D. I. Ryabchikov, editor.*** 356 pp. 1959. *Academy of Sciences, USSR, Moscow.* (QD172.R2 Ak13.3rtr)

CHEMISTRY—ORGANIC

a * **New Syntheses of 2,2′- and 3,3′-Bithienyl.** Fifty per cent yield from 2- and 3-thienylithium and cupric chloride. ***Salo Gronowitz and Hans-Olof Karlsson.*** *Arkiv för Kemi,* v. 17, no. 1, 1961, p. 89-92.

b **Preparation, Physical Properties and Infra-Red Studies of Several Alkyl and Aryl Phosphoric Acids.** Physical properties including cryoscopic molecular weights and infrared spectra. ***D. F. Peppard, J. R. Ferraro, and G. W. Mason.*** *Journal of Inorganic and Nuclear Chemistry,* v. 16, nos. 3-4, Feb. 1961, p. 246-256.

c * **Infrared Studies on Sulphate Esters. I. Polysaccharide Sulphates. II. Monosaccharide Sulphates.** Compounds show absorption bands, attributable to the S=O stretching vibration and the C-O-S, vibration respectively, in the 1,240 cm^{-1} and 820 cm^{-1} - 850 cm^{-1} regions. I. ***A. G. Lloyd, K. S. Dodgson, R. G. Price, and F. A. Rose.*** II. ***A. G. Lloyd and K. S. Dodgson.*** *Biochimica et Biophysica Acta,* v. 46, no. 1, Jan. 1, 1961, p. 108-120.

d * **Reactions of Aluminum Isopropylates With Some Phosphororganic Compounds.** The reaction between aluminum isopropylate and methyl-m-cresoxy-phosphinyl chloride and dimethyl-phosphinous acid was studied. New compounds were synthesized: methyl-m-cresoxyphosphinyl chloride, di-m-cresyl ether of methyl phosphinous acid, tris(methyl-m cresoxyphosphinoxy) aluminum and dimethyl phosphinoxy(diisopropoxy) aluminum. (*In Russian.*) O reaktsiiakh izopropilata aliuminiia s nekotorymi fosforganicheskimi soedineniiami. ***K. A. Andrianov, A. A. Zhdanov, L. M. Khananashvili, and A. S. Shapatin.*** *Zhurnal Obshcheĭ Khimii,* v. 31(93), no. 1, Jan. 1961, p. 224-228.

e * **Alkylation of Aromatic Compounds by Diene Hydrocarbons. I. Alkenylation of Anisole by Piperilene in the Presence of Ethyl Etherate of Boron Fluoride. II. Alkenylation of Anisole in the Presence of Boron Fluoride, Aluminum Chloride and Their Compounds With Orthophosphoric Acid.** (*In Russian.*) Alkilirovanie aromaticheskikh soedineniĭ dienovymi uglevodorodami. I. Alkenilirovanie anizola piperilenom v prisutstvii etilefirata ftoristogo bora. II. Alkenilirovanie anizola piperilenom v prisutstvii ftoristogo bora, khloristogo aluminiia i ikh soedineniĭ s ortofosfornoĭ kislotoĭ. ***E. A. Vdovtsova.*** *Zhurnal Obshcheĭ Khimii,* v. 31(93), no. 1, Jan. 1961, p. 95-108.

f * **Recent Methods Used With Organic Chemistry Preparations. IV. Application of Complex Boron Hydrides and of Diborane in Organic Chemistry.** Very selective methods of reduction with complex boron hydrides recently have obtained great importance. Similarities and differences in the reduction properties of these compounds and of other complex metal hydrides, for example of lithium-aluminum-hydride, are shown. (*In German.*) Neuere Methoden der präparativen organischen Chemie. IV. Anwendung von komplexen Borhydriden und von Diboran in der organischen Chemie. ***Erhard Schenker.*** *Angewandte Chemie,* v. 73, no. 3, Feb. 7, 1961, p. 81-107.

g * **On the Reaction of Thiocyanates With Organolithium and Organomagnesium Compounds.** Reaction with organic thiocyanates at −70° leads predominantly to the formation of sulfides. At 0°, and especially with Grignard reagents, the cleavage of thiocyanates leading to nitriles and the salt of thiols is more marked than at −70° and mixtures of sulfides, thiols and nitriles and secondary reaction products are formed. ***Salo Gronowitz and Rolf Håkansson.*** *Arkiv för Kemi,* v. 17, no. 1, 1961, p. 73-82.

h * **3-Substituted Thiophenes. New Preparations of 3-Thiophenethiol, 3-Thiocyanothiophene and 3-Iodothiophene.** Prepared from 3-bromothiophene through halogen-metal interconversion with *n*-butyllithium. ***Salo Gronowitz and Rolf Håkansson.*** *Arkiv för Kemi,* v. 16, nos. 4-5, 1961, p. 309-313.

i * **Diethyl-Se-Chloroselenophosphates.** (*In Russian.*) *Dietil-Se*-Khlorselenofosfaty. ***Ian Mikhal'skiĭ and Anna Markovskaia.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 1, Jan.-Feb. 1961, p. 108-110.

Homolytic Aromatic Substitution. XXI. The Arylation of Benzotrihalides. XXII. The Esters Formed in the Reaction of Benzoyl Peroxide With Aromatic Solvents. XXIII. A Redetermination of the Relative Rate of Phenylation of Nitrobenzene. Phenylation and *p*-nitrophenylation of benzotrichloride with benzoyl peroxide and *p*-nitrobenzoyl peroxide respectively. The reaction of benzotrifluoride with benzoyl peroxide. XXI. ***D. H. Hey, F. C. Saunders, and Gareth H. Williams.*** *XXII.* ***D. I. Davies, D. H. Hey, and Gareth H. Williams.*** XXIII. ***D. H. Hey, S. Orman, and Gareth H. Williams.*** *Chemical Society, Journal,* 1961, Feb., p. 554-569.

Reduction of Some Aldehydes and Ketones With Organotin Hydrides. Reductions with tri-*n*-butyltin hydride, triphenyltin hydride, di-*n*-butyltin dihydride, diphenyltin dihydride, *n*-butyltin trihydride and phenyltin trihydride. Exclusive pathway for reduction involves transfer of hydrogen to the substrate; metal-oxygen bonds are not formed. ***Henry G. Kuivila and O. F. Beumel, Jr.*** *American Chemical Society, Journal,* v. 83, Mar. 5, 1961, p. 1246-1250.

* **The Reaction Between *Iso*propoxy-methyl-phosphoryl Fluoride and Hydrogen Peroxide.** Reaction studied by measuring the amount of oxygen evolved during the reaction. The mechanism of the decomposition reaction is discussed. ***Gunnar Aksnes.*** *Acta Chemica Scandinavica,* v. 14, no. 10, 1960, p. 2075-2080.

Small-Ring Compounds. XXXI. Cyclobutane Derivatives From Adducts of Cyclohexenylacetylene and Fluorochloroethylenes. XXXII. The Reaction of Allylcarbinylamine-α-^{14}C (3-Butenyl-1-^{14}C-amine) With Nitrous Acid. XXXI. ***Clay M. Sharts and John D. Roberts.*** XXXII. ***E. Renk and John D. Roberts.*** *American Chemical Society, Journal,* v. 83, Feb. 20, 1961, p. 871-881.

* **A Dimer of Cyclobutadiene.** ***Margaret Avram, et al.*** *Tetrahedron Letters,* 1961, no. 1, Jan., p. 21-26.

* **New Synthesis of Octanediol-1,8.** Chloro-2-tetrahydropyran condenses easily with acetylene magnesium compounds prepared in tetrahydrofuran. The triple bond of the compounds thus obtained keeps its properties of addition with H; the heterocycle can be opened by acetic anhydride, especially the hydrogenated and saponified diacetates-1,8 yield octanediol-1,8. (*In French.*) Nouvelle synthèse de l'octanediol-1.8. ***Olivier Riobé and Lucien Gouin.*** *Comptes Rendus Hebdomadaires des Séances de l'Academie des Sciences,* v. 252, no. 9, Feb. 27, 1961, p. 1330-1332.

* **Organosilicon Compounds. XXII. Effects of the Composition of Silicon on the Direct Synthesis of the Methylchlorosilanes. XXIII. The Kinetics of the Reaction of Methyl Chloride With Chemically Pure Silicon by Catalysis With Copper. XXIV. The Kinetics of the Direct Synthesis of Methylchlorosilanes at High Pressure.** (*In German.*) Organosiliciumverbindungen. XXII. Einfluss der Zusammensetzung des Siliciums auf Die Direkte Synthese der Methylchlorsilane. XXIII. Über die Kinetik der Reaktion von Methylchlorid mit Chemisch Reinem Silicium Durch Katalyse Mit Kupfer. XXIV. Über die Kinetik der Direkten Synthese von Methylchlorsilanen Unter Erhöhtem Druck. XXII. ***J. Joklík and V. Bažant.*** XXIII. ***J. Joklík, M. Kraus, and V. Bažant.*** XXIV. ***M. Kadlec, M. Kraus, and V. Bažant.*** *Collection of Czechoslovak Chemical Communications,* v. 26, no. 2, Feb. 1961, p. 417-441.

* **A New Method to Produce S-Aminoacyl Derivatives of Cysteine Peptides.** In the method described, the production of a mercaptoacyl group corresponds to the condensation with N,N'dicyclohexylcarbodiimide ester of cysteine-containing peptide (I) with carbobenzoxyaminoacids (II). Ester of S-carbobenzoxyaminoacyl-N-carbobenzoxy-L-cysteine glycine (IIIa-IIIb) were obtained. (*In Russian.*) Novyĭ metod poluchenia S-aminoatsil'nykh proizvodnykh peptidov tsisteina. ***L. A. Shchukina, S. N. Kara-Murza, and G. F. Gromova.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 6, Feb. 1961, p. 1351-1353.

* **The Chemistry of Inner Complexes.** Reviews those aspects of the chemistry of inner complexes which have received most attention within recent years and indicates some of the current problems in the field. ***B. O. West.*** *Reviews of Pure and Applied Chemistry,* v. 10, no. 4, Dec. 1960, p. 207-242.

* **The Kinetics of a Direct Replacement of a Nitrogroup by Chlorine in Nitrobenzene and m-Chloronitrobenzene When Acted Upon by Carbon Tetrachloride.** (*In Russian.*) Issledovanie kinetiki reaktsii priamogo zameshcheniia nitrogruppy khlorom v nitrobenzole i m-khlornitrobenzole pri deĭstvii na nikh chetyrekhkhloristogo ugleroda. ***A. A. Ponomarenko.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 3, Jan. 21, 1961, p. 624-627.

* **Synthesis of Melamine Under Pressure of Ammonia. V. Studies on Deammoniating Reaction.** Reactions which take place in the fusion of dicyandiamide in the absence of ammonia were studied to clarify the effect of ammonia pressure on the synthesis of melamine by the fusion of dicyandiamide. (*In Japanese.*) ***Masahiro Kurabayashi and Kōshin Yanagiya.*** *Government Chemical Industrial Research Institute, Tokyo, Reports,* v. 56, Feb. 1961, p. 59-63.

* **New Improvement of the Synthesis of Flavones by Thermal Condensation in a Vacuum.** Applying vacuum in the thermal condensation of polyphenols and aroylacetates of ethyl in flavones permits a considerable lowering of the temperature of reaction and as a result the extension of this method to thermolabile reagents. The technique of isolation of the products of reaction is greatly simplified. (*In French.*) Nouvelle amélioration de la synthèse des flavones par condensation thermique sous vide. ***Robert Téoule, Georges Grenier, Henri Pacheco, and Jean Chopin.*** *Société Chimique de France, Bulletin,* 1961, no. 3, Mar., p. 546-549.

* **U. V. Spectra of Derivatives of 1,3,5-Triazine.** The synthesis of four 2,4-dichloro-6-(p-substituted phenyl) 1,3,5-triazines is described. The U. V. spectra of these compounds and those of the derivatives mentioned in the other papers of this series are dealt with and discussed. ***H. Koopman.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 80, Feb. 1961, p. 158-172.

* **Further Studies on the Reaction Between Halogen-Substituted Nitriles and Amines.** Trifluoroacetonitrile reacts easily with primary and secondary aliphatic, primary aromatic, and heterocyclic amines to give the corresponding amidines. N-Mono- and N-di-substituted dichloroacetamidines were prepared from dichloro-acetonitrile and amines. ***John C. Grivas and Alfred Taurins.*** *Canadian Journal of Chemistry,* v. 39, Apr. 1961, p. 761-764.

* **Potassium Derivatives of Fluorene as Intermediates in the Preparation of C$_9$-Substituted Fluorenes. III. The Influence of Solvent and Metal in the Formation of C$_9$-Substituted Fluorenes From 9-Fluorenyl Metals.** Mono- versus di-substitution at carbon 9 of fluorene when 9-fluorenyl-lithium, -sodium, or -potassium was allowed to react with an equimolar quantity of an alkyl or aralkyl halide in the solvents hexane (or heptane), dioxane, 1,2-dimethoxyethane (DME), 1,2-diethoxyethane (DEE), and tetrahydrofuran (THF). ***G. W. H. Scherf and R. K. Brown.*** *Canadian Journal of Chemistry,* v. 39, Apr. 1961, p. 799-807.

* **Condensation of Nitroacetic Ether With o-Aminophenylmercaptane.** During this process 2-oxime-2,3-diketodihydrobenzo-1,4-thiazine is obtained. Similar condensation of N-methyl-o-aminothiophenol leads to 2-oxime-2,3-diketo-4-methyl-dihydrobenzo-1,4-thiazine. Products of methylation, acetylation and benzoylation, derivatives of benzo-1,4-thiazine are obtained. Isonitrozoacetic ester when heated with o-aminophenyl-mercaptane forms an amide of benzothyazole acid. (*In Russian.*) O kondensatsii nitrougsusnogo efira s o-aminofenilmerkaptanom. ***A. I. Kiprianov and T. M. Verbovskaia.*** *Zhurnal Obshchei Khimii,* v. 31(93), no. 2, Feb. 1961, p. 531-537.

* **New Preparation Method to Produce Cis-Cyclobutane Dicarboxylic-1,2 Acid.** An easy method was developed to produce this acid and its anhydride, consisting in the action of a disodium derivative of butanetetracarboxylic 1,1,4,4-ester on 1,4-dibromobutane-tetracarboxylic-1,1,4,4-ester with subsequent acid saponification of the cyclobutanetetra-carboxylic-1,2 acids into the anhydride of cis-cyclobutane dicarboxylic-1,2 acid during the action of acetyl chloride. (*In Russian.*) Novyĭ preparativnyĭ metod polucheniia tsis-tsiklobutandikarbonovoĭ-1,2 kisloty. ***V. P. Gol'mov and Z. P. Malevannaia.*** *Zhurnal Obshchei Khimii,* v. 31(93), no. 2, Feb. 1961, p. 665-669.

* **Catalytic Alkylation of Tetraline. Report 3. Alkylation of Tetraline by Nonene 1 and N-Nonylene Alcohol.** The conditions for this alkylation with formation of branched β-nonyle trilines up to 47.6% for a nonene-1, and 50.5% for the initial nonylene alcohol were determined. Concerning tetraline in the reaction, the yield of β-nonyle tetralines is 23.3 and 50.5%, respectively. (*In Russian.*) Kataliticheskoe alkilirovanie tetralina. Soobshchenie 3. Alkilirovanie tetralina nonenom-1 N.nonilovym spirtom. ***N. I. Shuikin and N. A. Pozniak.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1961, no. 2, Feb., p. 326-329.

* **Studies on Relations Between the Color of Acid-Saccharified Starch and the 5-Hydroxy-Methyl-2-Furaldehyde.** Results of systematic researches on the role of 5-hydroxymethyl-2-furaldehyde (HMF) in the browning of glucose solution as one of the fundamental studies on the color of acid saccharified starch. Attempts to clarify the role of HMF in the browning by studying the quantitative relations between HMF and colored substance produced in heated glucose solution. (*In Japanese.*) ***Yoshiro Yoshihiro and Matao Nakamura.*** *Tokyo University, Institute of Industrial Science, Reports,* v. 10, no. 4, Jan. 1961, 48 pp.

* **Synthesis of 1-Methylenepyrrolizidine.** ***N. K. Kochetkov, A. M. Likhosherstov, and A. M. Kritsyn.*** *Tetrahedron Letters,* 1961, no. 3, Mar., p. 92-94.

CHEMISTRY—PHYSICAL

Densities of Solutions of Potassium in Liquid Ammonia and Deutero-Ammonia. The densities of solutions of K in liquid NH_3 have been measured at -33.7, 0.0, and 20.0 C over a concentration range from 0 to 1.2 mole liter^{-1}. The correlation of these results with paramagnetic resonance measurements is discussed in terms of a cavity-trapping model. ***Clyde A. Hutchison, Jr. and Donald E. O'Reilly.*** *Journal of Chemical Physics,* v. 34, Jan. 1961, p. 163-166.

Calculation of the Diamagnetic Susceptibility of N_2. The diamagnetic susceptibility of the N molecule has been calculated from wave functions that are constructed from gage invariant atomic orbitals. The result is -13.539×10^{-6} which agrees satisfactorily with the average experimental value -13.3×10^{-6}. ***H. F. Hameka.*** *Journal of Chemical Physics,* v. 34, Feb. 1961, p. 366-368.

Choice of Parameters for the Hückel π-Electronic Structure of Furan: Tentative Extension to Pyrrole and Thiophene. A comparison of the experimental bond lengths of furan with empirical bond length/bond energy relations for C-O bonds leads to the conclusion that the ratio of the C-O resonance integral to the C-C resonance integral of furan is between about 0.1 to 0.3. Use of this value along with a Coulombic integral parameter based upon the ultraviolet absorption spectrum of furan leads to a Hückel molecular orbital picture of the π-electronic structure of furan which is compatible with the known chemical reactivity of the molecule. ***Frank L. Pilar and John R. Morris, II.*** *Journal of Chemical Physics,* v. 34, Feb. 1961, p. 389-392.

* **Studies on the Chromatography and the Ultra-Violet Absorption of Aminoanthraquinones.** The purification of aminoanthraquinones by adsorption-chromatography and the identification by paper-chromatography were studied. Also, the ultraviolet absorptions of these pure compounds were measured. Seventeen aminoanthraquinones, such as 1-aminoanthraquinone, 2-aminoanthraquinone, 1-methylamino-4-β′-hydroxylethylaminoanthraquinone, and 1,4,5,8,-tetraaminoanthraquinone, were completely purified by adsorption-chromatography with the use of active alumina as adsorbent. The ultraviolet absorptions of these pure aminoanthraquinones were measured in alcoholic solutions. A discussion of the relations between the ultraviolet absorptions and the chemical structures is described. (*In Japanese.*) ***Yoshié Bansho, Iho Saito, and Shigeru Suzuki.*** *Government Chemical Industrial Research Institute, Tokyo, Reports,* v. 56, Jan. 1961, p. 12-20.

* **Application of Microscopic Methods to the Study of the Reaction Between Uranium Carbide and Metallic Zirconium.** Thermodynamically, uranium monocarbide and Zr react as follows: $UC + Zr \rightarrow CZr + U$. The kinetics of this reaction in the solid state were studied. For this purpose Zr was welded to uranium monocarbide. The specimens were heated at different temperatures. The zone near the weld was studied micrographically. A metallic uranium matrix appears in the primary carbide. The diffusion of C into the Zr carbide formed seems to control the kinetics in question. (*In French.*) Application des méthodes microscopiques à l'étude de la réaction entre le carbure d'uranium et la zirconium métallique. ***A. Accary and J. Trouvé.*** *Société Chimique de France, Bulletin,* 1961, no. 1, Jan., p. 26-30.

* **Kinetical Investigation of Catalytic Hydrogenation in the Liquid Phase. I. Absorption of Hydrogen.** Shows that catalytic hydrogenation carried out in the liquid phase by gaseous hydrogen can be considered as a combined process. (*In German.*) Untersuchung der kinetik der katalytischen hydrierung in flüssiger phase. I. Die absorption des wasserstoffes. ***F. Nagy, D. Móger, and A. Pethő.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 25, no. 1, 1960, p. 99-114.

* **Investigation of Multicomponent Heterogeneous Liquid Systems by the Phase Mass Method. II.** The mutual solubility of five three-component liquid heterogeneous systems at 17 ± 0.5, 30 and 40 has been investigated by measuring the phase mass. The systems contain a pair of heterogeneous solvents: aniline–n-heptane or aniline–iso = octane and as third component carbon tetrachloride, dichloroethane or chloroform. The shape of the equilibrium diagrams shows that with increase in temperature more uniform distribution takes place of the homogenizing component between the phases. Using the equilibrium diagrams one can arrange the solvents (saturated chlorine derivatives) in the following order of increasing homogenizing capacity: carbon tetrachloride, dichloroethane, chloroform. (*In Russian.*) Issledovanie mnogokomponentnykh geterogennykh zhidkikh sistam metodom izmereniia mass faz. II. ***L. S. Palatnik, G. P. Vinogorov, and M. B. Kagan.*** *Zhurnal Fizicheskoĭ Khimii,* v. 34, no. 11, Nov. 1960, p. 2396-2404.

Vibrational Relaxation in Liquids. Attempts have been made to apply the binary collision theory of vibrational deactivation to the liquid phase. The change of collision frequency with density was approximately accounted for, but the transition probability per collision was assumed independent of density. This later assumption is investigated here by an addition, to the direct intermolecular force, of the frictional and random forces of Brownian motion theory. ***Marshall Fixman.*** *Journal of Chemical Physics,* v. 34, Feb. 1961, p. 369-375.

* **O_2 Vibration Relaxation in Oxygen-Argon Mixtures.** Discusses the use of a new experimental technique for the determination of O_2 vibration and dissociation rates. ***Morton Camac.*** *Journal of Chemical Physics,* v. 34, Feb. 1961, p. 448-459.

O_2 Dissociation Rates in O_2-Ar Mixtures. Experimental measurements of the O_2 dissociation rate in shock-heated O-Ar mixtures were obtained with an ultraviolet light absorption technique. ***Morton Camac and Arthur Vaughan.*** *Journal of Chemical Physics,* v. 34, Feb. 1961, p. 460-470.

Kinetics of the Reactions of Alkyl Iodides With HI. ***Sidney W. Benson and Edward O'Neal.*** *Journal of Chemical Physics,* v. 34, Feb. 1961, p. 514-520.

Vacuum Ultraviolet Photolysis of Ethane: Molecular Detachment of Hydrogen. ***H. Okabe and J. R. McNesby.*** *Journal of Chemical Physics,* v. 34, Feb. 1961, p. 668-669.

The Absorption Spectra of Magnesium and Manganese Atoms in Solid Rare Gas Matrices. The absorption spectra have been investigated at liquid He temperature. An absorption system of Mg near 2850 Å and two for Mn near 4000 Å and 2800 Å have been observed. These abosrptions lie very close to the wavelengths of allowed atomic transitions and it is concluded on the basis of the evidence presented here that the absorbing species are atoms which are, in general, trapped at more than one type of site. ***O. Schnepp.*** *Physics and Chemistry of Solids,* v. 17, nos. 3-4, Jan. 1961, p. 188-195.

Kinetics and Mechanisms of the Thermal Decomposition of Ethane. I. The Uninhibited Reaction. II. The Reaction Inhibited by Nitric Oxide. ***K. J. Laidler and B. W. Wojciechowski.*** *Royal Society, Proceedings,* v. 260, ser. A, Feb. 7, 1961, p. 91-112.

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* **Acid-Induced Aromatic Hydrogen Exchange. III. Kinetic Isotope Effect in Hydrogen Exchange of Benzene and Toluene. Influence of Isotope Effect on Orientation.** ***Stig Olsson.*** *Arkiv för Kemi,* v. 16, no. 6, 1961, p. 489-500.

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A New Method for Kinetic Studies of the Iodine Exchange Between Organic and Inorganic Iodides. Separation processes play an important role in the study of exchange reactions. There is a need for a development in this field, especially for rapid exchange processes. An electrolytic precipitation procedure, and the conditions for obtaining exact results, have been studied. A brief description of the method is given and some of the results obtained are reported. ***Per Beronius and Ole Lamm.*** *Faraday Society, Transactions,* v. 56, Dec. 1960, p. 1793-1795.

b

* **New Aspects of the Interpretation of the Isotherms of Absorption of Binary Liquid Mixtures on Solid Surfaces.** The experimental isotherms were grouped according to five basic types, three of which are characterized by a more or less long linear portion. The extrapolation of these portions up to the axes of the ordinates permit the absolute determination of the content of the superficial adsorbed layer. These calculations show that this layer is always monomolecular when the adsorption is merely physical. (*In French.*) Nouveaux aspects de l'interprétation des isothermes d'absorption de mélanges liquides binaires sur des surfaces solides. ***Géza Schay and Lajos Nagy.*** *Journal de Chimie Physique,* v. 58, Feb. 1961, p. 149-158.

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The Determination of Electron Affinities by the Method of Mayer. I. The Experimental Technique and Interpretation. The method of measuring electron affinities devised by Mayer has been modified to avoid certain sources of error. An alternative mechanism for its operation is suggested, depending on the adsorption of the substrate molecule on the hot filament. Evidence is presented in support of this alternative interpretation. ***F. M. Page.*** *Faraday Society, Transactions,* v. 56, Dec. 1960, p. 1742-1751.

c

Self-Consistent Molecular Orbital Calculations on π-Electron Systems. I. The Electronic Spectrum of Borazine. A calculation of the electronic spectrum of borazine is described. Only the π-electrons are considered explicitly, and the zero differential overlap approximation is used. Results are given for different sets of parameters, and it is found possible to give an interpretation of the u.-v. spectra of both borazine and some substituted borazines. ***D. W. Davies.*** *Faraday Society, Transactions,* v. 56, Dec. 1960, p. 1713-1718.

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Kinetics of the Deuterium Exchange Between Diborane and Dimethylaminodiborane. The course of the reaction was followed by means of gas density measurements. The concentrations of both reactants were varied over a 20-fold range in order to establish the orders of the reaction. The reaction was found to be first order with respect to dimethylaminodiborane and half-order with diborane. The activation energy was found to be 27.8±3 kcal. By variation of the surface-to-volume ratio it was determined that, to within experimental error, the reaction is homogeneous. ***J. S. Rigden and W. S. Koski.*** *American Chemical Society, Journal,* v. 83, Feb. 5, 1961, p. 552-555.

d

Kinetics of Liquid Phase Hydrogenation. II. Hydrogenation of Aromatic and Aliphatic Nitrocompounds Over a Colloidal Platinum Catalyst. III. The Nature of Platinum Oxide Catalysts. ***Hsien-Cheng Yao and P. H. Emmett.*** *American Chemical Society, Journal,* v. 83, Feb. 20, 1961, p. 796-801.

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* **Investigation of the Solubility in the Ternary NH_4HCO_3-NaCl-H_2O System.** Data obtained in studying a diagonal 20° section of NH_4HCO_3-NaCl until complete hardening in the Na, NH_4/Cl′,HCO_3', H_2O system reveal that with the decrease of temperature in the isotherms of the fourfold Na, NH_4/Cl′,HCO_3', H_2O system, the field of sodium bicarbonate in the direction of the metastable diagonal increases and consequently the corresponding solubility of this salt decreases. Below -6.7 the field of the sodium bicarbonate is exhausted and replaced by an ice field. (*In Russian.*) Issledovanie rastvorimosti v troĭnoĭ sisteme NH_4HCO_3-NaCl-H_2O. ***M. V. Goloshchapov.*** *Zhurnal Prikladnoĭ Khimii,* v. 34, no. 1, Jan. 1961, p. 138-143.

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Kinetics of Some Electron Transfer Reactions of Cobalt(III). The rates of reaction of $V_{aq}++$ with complexes $RL(R = Co^{III}(NH_3)_5$: L = OH_2, NH_3, Cl^-) have been studied in H_2O and in D_2O. The rate of reaction of $Cr_{aq}++$ with RNH_3+++ has been studied in the two media. Rates, ligand and isotope effects are compared with those found in reactions, the nature of whose activated complexes are more definitely understood. ***Allan Zwickel and Henry Taube.*** *American Chemical Society, Journal,* v. 83, Feb. 20, 1961, p. 793-796.

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The Photochemical Reduction of Bromotrichloromethane by Derivatives of 1,4-Dihydropyridine. 1,2,6-Trimethyl-3,5-dicarbomethoxy-1,4-dihydropyridine and 2,6-dimethyl-3,5-dicarbomethoxy-1,4-dihydropyridine reduce bromotrichloromethane to $CHCl_3$. The reaction has been shown to proceed by a free-radical chain mechanism, and may be initiated either photochemically or thermally. The H atom of the $CHCl_3$ molecule originates in the 4-position of the dihydropyridine ring. The implications of these findings for the reaction mechanism are discussed. ***Joseph L. Kurz, Robert Hutton, and F. H. Westheimer.*** *American Chemical Society, Journal,* v. 83, Feb. 5, 1961, p. 584-588.

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The Dipole Moment of *p*-Benzoquinone: Electro-optic Birefringence. The results indicate that, as expected, this centro-symmetric molecule has no permanent dipole moment, nor does it have an induced moment in an electric field large enough to explain the polarization differences. The principal polarizabilities and the total electronic polarization of *p*-benzoquinone have also been calculated using the concept of bond polarizabilities. The calculated polarization is in good agreement with measured values. ***Elliot Charney.*** *American Chemical Society, Journal,* v. 83, Feb. 5, 1961, p. 578-580.

h

The Fluorescence of Sulfur Dioxide. Fluorescence spectra of SO_2 are obtained for the first time by direct optical excitation to the second electronic state above the normal state. Transitions are observed to vibrational levels of the normal state from vibrational levels of both the second and the first excited electronic states. The latter state could not be populated directly because of low absorption coefficients. ***Kenneth F. Greenough and A. B. F. Duncan.*** *American Chemical Society, Journal,* v. 83, Feb. 5, 1961, p. 555-560.

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The Activation Energies of Proton Transfer Reactions in Ammonium and Methylammonium Solutions Measured by the Nuclear Magnetic Resonance Technique. ***T. M. Connor and A. Loewenstein.*** *American Chemical Society, Journal,* v. 83, Feb. 5, 1961, p. 560-563.

i

The Mechanism of Solvolysis of Nitrostyrenes. The kinetics of hydrolysis of 3,4-methylenedioxy-β-nitrostyrene, to piperonal and nitromethane, are characteristic of two consecutive, pseudo-first-order reactions over the *p*H range -0.8 to 6. The first is reversible and shows general base catalysis, with the rate constant a nonlinear function of the acetate ion concentration. The rate of the second is *p*H dependent. A mechanism is proposed consistent with these observations. ***Thomas I. Crowell and Andrew W. Francis, Jr.*** *American Chemical Society, Journal,* v. 83, Feb. 5, 1961, p. 591-593.

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Formation and Identification of Unique Radical Sites in Irradiated Amides. The free radicals produced in each of ten N-substituted amides by irradiation with 2-Mev. electrons have been characterized by their e.p.r. spectra. A single species of radical is formed in each of nine of the amides. The *G* (radical) yield for N-(*n*-propyl)-propionamide is 4.7±1.4. ***E. J. Burrell, Jr.*** *American Chemical Society, Journal,* v. 83, Feb. 5, 1961, p. 574-577.

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Kinetics of Thiosemicarbazone Formation of Some Alkylbutyrophenones. The energies and entropies of activation have been determined for the thiosemicarbazone formation of butyrophenone and three alkylbutyrophenones in anhydrous methanol with a pyridine-pyridine hydrochloride buffer. The data show that the "*ortho*-effect" of a methyl group which slows the reaction by a factor of 20 is primarily a result of an increased E_a

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and not a change in ΔS^*. ***Jane L. Maxwell, M. Joanne Brownlee and Maretta P. Holden.*** *American Chemical Society, Journal*, v. 83, Feb. 5, 1961, p. 589-591.

Optical Rotatory Dispersion Studies. XLI. α-Haloketones (Part 9). Bromination of Optically Active *cis*-1-Decalone. Demonstration of Conformational Mobility by Rotatory Dispersion. *cis,cis*-1-Decalol has been resolved for the first time through its 3β-acetoxy-Δ^5-etienate and a convenient preparation of the resolving agent, 3β-acetoxy-Δ^5-etienic acid, is reported. The absolute configurations of the derived (−)-*cis*-1-decalone and (−)-*trans*-1-decalone were established by comparing their rotatory dispersion curves with those of their 10-methyl analogs of known relative and absolute stereochemistry. ***Carl Djerassi and J. Staunton.*** *American Chemical Society, Journal*, v. 83, Feb. 5, 1961, p. 736-743.

The Energy Difference Between the Chair and Boat Forms of Cyclohexane. The Twist Conformation of Cyclohexane. A pair of stereoisomeric lactones have been prepared by a stereo-rational synthesis, and have been submitted to combustion calorimetric and heat of vaporization determinations. These results showed that the enthalpy of these compounds differ. ***William S. Johnson, et al.*** *American Chemical Society, Journal*, v. 83, Feb. 5, 1961, p. 606-614.

* **The Crystal Spectrum of Perylene.** The electronic absorption spectrum of crystalline perylene has been examined in the spectral region 3000-4700 Å. The lowest energy electronic state of perylene has a large oscillator strength and the crystal spectrum deviates considerably from that calculated from a weak coupling (Davydov) model. ***Robin M. Hochstrasser.*** *Canadian Journal of Chemistry*, v. 39, Mar. 1961, p. 451-458.

* **Chemical Properties of Some Vanadium Compounds in Molten Alkali Chlorides.** The value of the solubility products of some oxides in the molten LiCl-KCl eutectic are given. The constants of some complexes of V and of the O^{2-} particle were determined semiquantitatively. This made it possible to establish the theoretical diagram (E,pO^{2-}) for the redoxy-system V(IV)/V(V). Chemical reactions illustrate the anticipations allowed by the data obtained about this diagram and the constants quoted. (*In French.*) Propriétés chimiques de quelques composés du vanadium dans les chlorures alcalins fondus. ***Roger Molina.*** *Société Chimique de France, Bulletin*, 1961, no. 2, Feb., p. 301-308.

* **Exchange Reactions Between Zinc and Its Ions.** The exchange reaction in solution has been studied by means of radioactive zinc-65. Polycrystalline Zn and Zn bicrystals were used under conditions where the radioactive material was incorporated either in the solid or the liquid phase. Strain-free clean surfaces were obtained and autoradiographs taken. ***J. E. Sandor.*** *Canadian Journal of Chemistry*, v. 39, Mar. 1961, p. 393-400 + 1 plate.

Oxidation-Reduction Reactions in Ionizing Solvents. Contains the 24 papers presented at the Apr., 1960, meeting and discussion of the above. *Faraday Society, Discussions No.* 29, 1960, 261 pp. (TK1 F22d Vis.)

* **Kinetics and Thermodynamics of the Crystal Structure Transformation of Spectroscopically Pure Anatase to Rutile.** Kinetics and thermodynamics of the transformation have now been carefully investigated. ***C. N. R. Rao.*** *Canadian Journal of Chemistry*, v. 39, Mar. 1961, p. 498-500.

The Variation of Bond Type in Cyclopentadienyl-Metal Compounds. Variation of bond type in cyclopentadienyl-metal compounds with the nature of the central element is reviewed. Compounds from the elements of Groups I to IV are compared with those of the transition elements. ***David A. Brown.*** *Chemical Society, Journal*, 1961, Feb., p. 690-701.

Reactions of Oxygen With Pure Tungsten and Tungsten Containing Carbon. Explains why O_2 was made to flow at constant rates through a system consisting of a tungsten ribbon, an ion gage, and a conventional mass spectrometer. ***J. A. Becker, E. J. Becker, and R. G. Brandes.*** *Journal of Applied Physics*, v. 32, Mar. 1961, p. 411-423.

Kinetics of Coordinate Bond Formation. IV. Kinetic Isotope Effect in the Reaction NH_3+BF_3. V. Kinetics of the Reaction $P(CH_3)_3$+BF_3. An isotopic rate ratio has been measured at room temperature for the reactions $NH_3(ND_3)$+BF_3 = NH_3BF_3 (ND_3BF_3). ***G. B. Kistiakowsky and C. E. Klots.*** *Journal of Chemical Physics*, v. 34, Mar. 1961, p. 712-717.

Intramolecular Energy Transfer in Rare Earth Chelates. Role of the Triplet State. Results of luminescence studies on chelates of La^{3+}, Sm^{3+}, Eu^{3+} Gd^{3+}, Tb^{3+}, Dy^{3+}, Tm^{3+}, Yb^{3+}, and Lu^{3+} are reported. ***G. A. Crosby, R. E. Whan, and R. M. Alire.*** *Journal of Chemical Physics*, v. 34, Mar. 1961, p. 743-748.

Kinetics of Crystal Nucleation in Some Normal Alkane Liquids. Nucleation behavior of $C_{16}H_{34}$, $C_{17}H_{36}$, $C_{18}H_{38}$, $C_{24}H_{50}$, and $C_{32}H_{66}$—was investigated by the droplet technique. ***David Turnbull and Robert L. Cormia.*** *Journal of Chemical Physics*, v. 34, Mar. 1961, p. 820-831.

* **Thermal Diffusion in Gaseous Mixtures.** The thermal separation is obtained by gaseous H_2-N_2O and N_2-SO_2 mixtures for the interval of temperature 300-480 K. The values of the thermal diffusion relationship (K_T) and of the thermal separation relationship (R_T) are given for each gas mixture. These values decrease gradually when the temperature decreases. The effect is measured with a katharimeter and the results are compared with the theoretical predictions. (*In French.*) Diffusion thermique dans les mélanges gazeux. ***M. El Nadi and N. Faragi.*** *Journal de Chimie Physique*, v. 58, Mar. 1961, p. 296-299.

* **Evaporation of Germanium in Tellurium Vapors.** An abnormally high rate of evaporation of crystalline Ge in Te vapors was found. At 900 C the rate of evaporation increased linearly with the increase of pressure of the Te vapors from 10^{-7} to 1 mm of the Hg column, beyond which saturation began. The heat of evaporation of Ge in Te vapors at the pressure of the last $P_{Te} = 6 \cdot 10^{-1}$ mm of the Hg column was equal to 12.4 k cal/mol, that is seven times lower than the heat of evaporation of Ge in a vacuum. (*In Russian.*) Isparenie germaniia v parakh tellura. ***V. D. Ignatkov and V. E. Kosenko.*** *Fizika Tverdogo Tela*, v. 3, no. 1, Jan. 1961, p. 89-93.

Dissolving Uranium in Nitric Acid. Information concerning the influence of various factors on the rate of dissolution of massive U metal in HNO_3. The initial rate increased with increasing C and N content of the sample. ***J. R. Lacher, John D. Salzman, and J. D. Park.*** *Industrial and Engineering Chemistry*, v. 53, Apr. 1961, p. 282-284.

Electrochromism, a Possible Change of Color Producible in Dyes by an Electric Field. Theoretical considerations suggest that the absorption and emission spectra of certain dyes may be shifted by hundreds of angstroms upon application of a strong electric field. The theory of the effect is outlined and is discussed in terms of compounds which might be expected to show it most strongly. ***John R. Platt.*** *Journal of Chemical Physics*, v. 34, Mar. 1961, p. 862-863.

The Radiochemistry of Iron. ***J. M. Nielsen.*** 42 pp. Aug. 1960. National Research Council, Washington, D. C. (QD601 N21.6i)

The Radiochemistry of Carbon, Nitrogen, and Oxygen. ***J. Hudis.*** 20 pp. Dec. 1960. National Research Council, Washington, D. C. (QD601 N21.6ca)

The Radiochemistry of Zinc. One of a series of booklets. Others of the series cover Fe, Ma, and C, N_2, and O_2. ***Harry G. Hicks.*** 58 pp. June 1960. National Research Council, Washington, D. C. (QD601 N21.6zi)

The Radiochemistry of Manganese. ***G. W. Leddicotte.*** 22 pp. Oct. 1960. National Research Council, Washington, D. C. (QD601 N21.6ma)

COATINGS

The Spread of Molten Tin on Mild Steel Reduced in Hydrogen or Treated With Molten Fluxes. Concludes that the use of molten fluxes for tinning gives far better "wetting" than can be achieved by gaseous reduction of the strip at high

temperatures before tinning. ***E. T. Turkdogan and Susan Zador.*** *Iron and Steel Institute, Journal,* v. 197, pt. 3, Mar. 1961, p. 233-239.

Metallizing Nickel Powder. Involves vacuum blasting to prepare steel before surfacing with metal-spray gun. ***W. B. Keyser.*** *Welding Journal,* v. 40, Mar. 1961, p. 229-231.

Developments in the Protection of Magnesium. ***J. K. Wilson and F. D. Waldron-Trowman.*** *Light Metals,* v. 24, Feb. 1961, p. 38-39.

* **Preparation and Properties of Esters of Monohydric Alcohols and Fatty Acids of Tall Oils.** ***S. T. Bauer, Patricia R. Gill, and R. E. Price.*** *American Oil Chemists' Society, Journal,* v. 38, Mar. 1961, p. 127-130.

Tin Plated Cans Sprayed With Soluble Oil Formulation Show Increased Rust Resistance. A soluble oil formulation was developed for the treatment of cans. The formulation was an emulsion of a soluble oil in water containing sodium nitrite inhibitor and a surface active agent (Deriphat 151). ***Raymond K. Cohen.*** *Corrosion,* v. 17, Mar. 1961, p. 75.

NASA Develops Space Paints for Satellites. Paints to control satellite temperatures are aim of program that has already produced coatings for Explorers VII and VIII. *Chemical & Engineering News,* v. 39, no. 8, Feb. 20, 1961, p. 50-52.

* **A New Device for the Examination of the Hardness and Elasticity of Lacquer Coatings.** (*In Polish.*) Nowy przyrząd do badania twardości i elastyczności powłok lakierowych. ***Zbigniew Jedliński and Zdzisław Hippe.*** *Przemysł Chemiczny,* v. 39, no. 12, Dec. 1960, p. 787-789.

Flooding and Floating in Paints. II. The causes and the associated phenomenon of Bénard cell formation. Some of the theories proposed and suggested cures are discussed. ***L. A. Logue.*** *Paint Manufacture,* v. 31, Feb. 1961, p. 55-61.

Hypalon and Neoprene Coatings. Results of tests on five types of coatings immersed in sea water and exposed to sea air and spray. ***V. Romanovsky.*** *Paint Manufacture,* v. 31, Feb. 1961, p. 51-54.

* **Transformer Repainting Reduced by New Paint, Field Tests Show.** Five-year field test of a rubber-like paint assures customers that network transformers will seldom have to be repainted. By-product design changes are suggested by inspections. ***E. C. Bain and C. G. S. Lewis.*** *Electric Light and Power,* v. 39, no. 5, Mar. 1, 1961, p. 33-35.

Present and Future Problem Areas for High Temperature Inorganic Coatings. ***J. D. Walton, Jr.*** *American Ceramic Society Bulletin,* v. 40, Mar. 15, 1961, p. 136-141.

* **Sampling and Testing of Paint.** Physical properties of paints are considered from the viewpoint of the materials going into the paints. ***Helene R. Johnson.*** *Paint Industry Magazine,* v. 76, Feb. 1961, p. 15-18.

* **Problems Encountered in Rapid Curing.** Concerns protective coatings for tinplate. ***G. H. Bendix and J. N. Demsey, Jr.*** *Paint Industry Magazine,* v. 76, Feb. 1961, p. 11-14.

* **Drawing Aluminum Cans From Precoated Strip.** Development of new methods and automated equipment for producing cans has reduced this cost to a point where Al cans are competitive with tinplate cans. *Automation,* v. 8, Feb. 1961, p. 79-81.

Technology of Non-Metallic Coating. Discusses modern theoretical principles of film formation, the mechanism of the aging of coatings, organic lining materials, the properties of various coatings (including nonmetallic inorganic coatings) and their rational fields of application. The theoretical principles underlying corrosion protection are elucidated; and there is information on the modern equipment used for applying coatings, with sample designs of typical equipment. Safety measures are also dealt with. (Translated from Russian.) ***A. Ya. Drinberg, E. S. Gurevich, and A. V. Tikhomirov.*** 531 pp. 1960. Pergamon Press, New York. (TA462 D83ttr)

* **The Corrosion Resistance of Some Sprayed Metallic Coatings.** Reviews applications of sprayed metallic coatings in corrosive environments. Results show that the success of some coatings is due to their ability to provide cathodic protection. Chemical blocking may also modify such sacrificial behavior so as to develop a more durable surface. ***T. K. Ross and E. L. Smith.*** *British Chemical Engineering,* v. 6, Mar. 1961, p. 172-175.

* **Synthetic Resins. VI. Epoxy Resins (Section B).** ***Harold P. Preuss.*** *Metal Finishing,* v. 59, Mar. 1961, p. 51 + 4 pages.

Polyester Resins for Coating Applications. The use of polyesters in this field permits very attractive finishes with desirable qualities, but inhibition of curing by atmospheric oxygen has proved something of a drawback to commercial application. Reviews the chemical aspect of some of the developments which have contributed to successful surface coating with polyester resins. ***T. L. Phillips.*** *British Plastics,* v. 34, Feb. 1961, p. 69-72.

* **A Rapid Method of the Determination of the Porosity of Organic Protective Coatings.** An electrolytic method worked out for the determination of the porosity of organic protective coatings on steel and other metallic surfaces (e.g., Al). (*In Polish.*) Szybka metoda oznaczania porowatości organicznych powłok ochronnych. ***Zdzisław Hippe and Zbigniew Jedliński.*** *Przemysł Chemiczny,* v. 40, no. 1, Jan. 1961, p. 40-41.

Removal of Organic Coatings. Results of Adherometer measurements has led to the abandonment of force of adhesion for the more realistic work of hesion, the work required to remove a unit volume of an organic coating from a surface. ***L. Reed Brantley.*** *Industrial and Engineering Chemistry,* v. 53, Apr. 1961, p. 310.

* **The Irradiation Resistance of Varnishes.** Some examples of irradiation conditions to which varnishes may be subjected are given, and various experimental techniques which have been employed in the laboratory to examine the effects of irradiation on such materials are described. ***F. B. Waddington.*** *Oil & Colour Chemists' Association Journal,* v. 44, Mar. 1961, p. 179-187.

Polyester Wood Finishes. In the Continental furniture industry, polyester has practically eliminated nitrocellulose for wood finishes. ***B. M. Letsky.*** *Paint Technology,* v. 25, Mar. 1961, 20 + 3 pages.

A Theory of Drying With Air. The pattern of air flow developed on a drying surface by the Gardner drier produces a laminar boundary layer film which is highly analogous to the Pohlhausen theory for a thin, flat plate immersed in a deep, uniform stream of fluid. ***T. A. Gardner.*** *Paint Technology,* v. 25, Mar. 1961, p. 15 + 5 pages.

* **Progress in the Development of Fluorescent Inks and Their General Suitability for Letterpress, Litho and Gravure.** ***L. W. Harrison.*** *British Printer,* v. 74, Mar. 1961, p. 126-127.

* **Study on the Spangle in Hot-Dip Galvanized Coating.** Deals with the influence of Al and Sn additions on the spangles on galvanized coating which are of commercial importance because of their pleasing and aesthetic appearance. (*In Japanese.*) ***Genjiro Mima, Kazuo Kajikawa, and Tadashi Kato.*** *Tetsu to Hagané (Journal of the Iron and Steel Institute of Japan),* v. 47, no. 2, Feb. 1961, p. 129-133.

Solid Lubricants as Organic Finishes. Typical solid lubricants considered are MoS_2, lead iodide, Ag_2S and WS_2. ***Lowell C. Horwedel.*** Paper from "Technical Proceedings of the Forty-Seventh Annual Convention, American Electroplaters' Society, July 24-28, 1960". p. 63-65, 1960. American Electroplaters' Society, Inc., Newark, N. J. (TS670 AM35p Vis.)

Adhesion of Organic Enamels to Electrodeposited Nickel. Various aqueous solutions of organic and inorganic compounds are employed as post-treatments for the electrodeposits. The solutions apparently react either to cause a conversion-type film on the Ni surface or to deposit a thin film of material which becomes strongly bonded to Ni. The film produced is receptive to organic coatings. ***F. X. Carlin.*** Paper from "Technical Proceedings of the Forty-Seventh Annual Convention, American Electroplaters' Society, July 24-28, 1960". p. 59-62, 1960.

American Electroplaters' Society, Inc., Newark, N. J. (TS670 AM35p Vis.)

Argon Flush: Key to Fabrication of Titanium-Clad Steel. *C. L. Kobrin. Iron Age,* v. 187, no. 17, Apr. 27, 1961, p. 110-111.

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

* **Data Communication.** Wires, telephone lines, and microwave are being utilized to hurry data between decentralized points. ***George O. Vincent.*** *Data Processing,* v. 3, Feb. 1961, p. 7-12.

Digital Computers for Television Switching Control. This system offers a considerable advance over previously used techniques with respect to functional capacity, ease of revision of program schedule, and adaptability to changes in operating practice. ***A. B. Ettlinger.*** *IRE Transactions on Broadcasting,* v. BC-7, no. 2, Mar. 1961, p. 29-36. (TK1 In6.6bt Vis.)

Use of Digital Computer to Determine Broadcast Station Nighttime Interference. Computer program developed and used to determine night-time sky-wave signal interference to ground-wave service is described. The formulas and sequences used by the program are discussed. A sample calculation of the program is given. The advantages of a such a program are accuracy, reliability, speed, and convenience. ***Israel Akerman.*** *IRE Transactions on Broadcasting,* v. BC-7, no. 2, Mar. 1961, p. 5-11. (TK1 In6.6bt Vis.)

Designing. Thin Magnetic Film Memories for High-Speed Computers. Memory planes using Ni-Fe films 2,000 angstroms thick are made reproducibly by vacuum deposition on glass under influence of a magnetic field. ***E. E. Bittmann.*** *Electronics,* v. 34, no. 9, Mar. 3, 1961, p. 39-41.

A Linear to Logarithmic Convertor Unit for Use With a Linear Counting Ratemeter. ***J. Turnbull and D. N. Walder.*** *Electronic Engineering,* v. 33, Apr. 1961, p. 230-239.

An Analogue Computer for Aerial Radiation Patterns. For aerial arrays comprising a number of radiating elements, mounted on a central support mast. ***H. Page, G. J. Phillips, and J. A. S. Fox.*** *Electronic Engineering,* v. 33, Apr. 1961, p. 206-212.

* **Statistical Design of Linear Discrete-Data Control Systems Via the Modified *z*-Transform Method.** A solution is presented for the analytical design of digital controller in accordance with a specified optimum criterion making use of the modified *z*-transform technique. ***Julius T. Tou.*** *Franklin Institute, Journal,* v. 271, no. 4, Apr. 1961, p. 249-262.

* **Jump Resonance in a Third Order Nonlinear Control System.** An approximation reveals that jump resonance can be precluded if the forcing function does not exceed a calculable value referred to as the threshold value. ***Wellington W. Koepsel.*** *Franklin Institute, Journal,* v. 271, no. 4, Apr. 1961, p. 292-303.

* **Discrete Analogue-Computer Compensation of Sampled-Data Control Systems.** Describes an analogue computer which can solve pulse-transfer functions and operate as a discrete controller for compensation of sampled-data or continuous systems. ***T. Glucharoff.*** *Institution of Electrical Engineers, Proceedings,* v. 108, pt. B, no. 38, Mar. 1961, p. 167-179.

Computer Design of Multiple-Output Logical Networks. A computer program has been prepared which automatically derives a set of minimal Boolean expressions describing a given logical network with multiple-output lines. ***Thomas C. Bartee.*** *IRE Transactions on Electronic Computers,* v. EC-10, no. 1, Mar. 1961, p. 21-30.

* **Automation—Its Evolution and Future Direction. II.** ***James T. Culbertson.*** *Computers and Automation,* v. 9, Dec. 1960, p. 34 + 1 page.

* **Computing Services Survey.** Results of a solicited survey. ***Neil Macdonald, editor.*** *Computers and Automation,* v. 9, Dec. 1960, p. 7-11.

A High Speed Analogue to Digital Convertor. A high speed analogue to digital convertor capable of performing 55,000 converisons per sec from an analogue voltage to an 8-bit binary code. The equipment uses transistors as the active elements. ***N. Winterbottom and J. S. B. Walters.*** *Electronic Engineering,* v. 33, Mar. 1961, p. 144-149.

Digital Computers and Nuclear Reactor Calculations. Intends to acquaint nuclear engineers and scientists with the use of digital computers in the design of nuclear reactors. Includes reactor problems which present interesting and illuminating examples of the use of numerical analysis and digital computers. ***Ward C. Sangren.*** 208 pp. 1960. John Wiley & Sons, New York. (QA76 Sa58d)

Principles of Control Systems Engineering. A lucidly written, integrated, and comprehensive treatment of feedback control systems. ***Vincent Del Toro and Sydney R. Parker.*** 686 pp. 1960. McGraw-Hill, New York. (TJ216 D38p)

* **The CLIP Translator.** A CLIP Compiler for the IBM 709 computer has been written. As a test of the adequacy of the language, the CLIP compiler was written in its own language and has successfully reproduced itself. ***Donald Englund and Ellen Clark.*** *ACM Communications,* v. 4, Jan. 1961, p. 19-22.

ELECTRICAL ENGINEERING

* **Development in Magnesium Batteries.** ***Prem Behari Mathur and Nithiyanandan J. Paul.*** *Journal of Scientific & Industrial Reseach,* v. 19A, Dec. 1960, p. 597-602.

* **Circuits Forming High Intensity Magnetic Field Pulses Close to Rectangular Shape.** A method for the discharge of a calculated artificial long line with an inductance coil, and an improved switching circuit with one Hg excitron are described. Pulses of magnetic field intensity up to 10^6 e and of a length up to 200 mk sec were obtained. Their planar region (H = const with up to ±1.5% accuracy) consisted of 35% of the general duration of the pulses. (*In Russian.*) Skhemy, formiruiushchie impul'sy magnitnogo polia bol'shoĭ napriazhennosti, blizkie po forme k priamougol'nym. ***A. G. Bonch-Osmolovskiĭ and G. K. Ivanov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Radiotekhnika,* 1960, no. 6, Nov.-Dec., p. 558-562.

* **Analysis of the Commutation Equation With the Aid of Electronic Analog Computer. (Consideration of Coil Resistance Effects).** Properties of commutation in fundamental cases where the brush width is equal to the segment pitch of commutator have been clarified. These results are very important in practical problems of commutation, and are available for the generalization of the theory. ***K. Ototake and H. Genchi.*** *ETJ of Japan,* v. 6, no. 1, 1960, p. 12-16.

* **Detection of Disjunets of Switching Functions and Multi-Level Circuit Design.** The multi-level electronic circuit synthesized from the component functions yields improved economy in several cases with regard to number of logical circuit elements. ***Amarendra Mukhopadhyay.*** *Journal of Electronics and Control,* v. 10, no. 1, Jan. 1961, p. 45-55.

* **FM 120/7000—A Radio Relay System for 4 to 120 Telephone Channels.** ***Fritz Kaiser.*** *Siemens Review,* v. 28, no. 3, Mar. 1961, p. 85-88.

Electric Power From Gas Jets. Describes how kinetic energy from a high-velocity jet can be converted directly into electrical energy. The jet is made electrically conducting and allowed to interact with a transverse magnetic field, with subsequent braking of the gas. ***D. J. Harris.*** *Institution of Electrical Engineers, Journal,* v. 7, no. 74, Feb. 1961, p. 84-86.

Amplification in Nonlinear Reactive Networks. ***W. R. Bennett.*** *IRE Transactions on Circuit Theory,* v. CT-7, no. 4, Dec. 1960, p. 440-446. (TK1 In6.6c Vis.)

Periodic Solutions of Forced Systems Having Hysteresis. ***H. D. Block.*** *IRE Transactions on Circuit Theory*, v. CT-7, no. 4, Dec. 1960, p. 423-431. (TK1 In6.6c Vis.)

Properties and Theory of the Electric Arc. A review with 123 references. ***H. Edels.*** *Institution of Electrical Engineers, Proceedings*, v. 108, pt. A, no. 37, Feb. 1961, p. 55-69.

* **A Grapho-Numerical Method for Calculating Magnetic Admittances of Electric Apparatus.** As compared with the analytic method, the method developed to calculate magnetic chains is more accurate and takes into full account the magnetic conductivities near the air gaps on the separate parts of the magnetic circuits, and especially in the zone of arrangement of the magnetizing coil. According to the field pattern, the zone of the working current and of the leakage flux is easily determined, which alloys a graphical evaluation of the merits and defects of the design selected for the magnetic field. (*In Russian.*) Graphoanaliticheskiĭ metod rascheta magnitynkh provodimosteĭ elektricheskikh apparatov. ***B. K. Bul'.*** *Elektrichestvo*, 1961, no. 3, Mar., p. 28-35.

Three-Layer Negative-Resistance and Inductive Semiconductor Diodes. Shows that in transistor-like structures with the base either open-circuited or directly shorted to the emitter region, negative resistance are observed when any two of several effects occur simultaneously. ***W. W. Gärtner and M. Schuller.*** *I.R.E. Proceedings*, v. 49, Apr. 1961, p. 754-767.

The Choice and Design of D.C. Convertors. Design steps are indicated and two practical designs are worked out as examples. ***J. S. Bell and P. G. Wright.*** *Electronic Engineering*, v. 33, Apr. 1961, p. 226-231.

ELECTROCHEMISTRY

The Surface Chemistry of Metals and Semiconductors. Contains the 23 papers presented at the Joint Symposium of the Corrosion and Electronics Divisions of the Electrochemical Society on the Surface Chemistry of Metals and Semiconductors held in Columbus, Ohio. The material is grouped into five parts: chemistry and physics of surfaces; imperfections and surface behavior; electrode behavior of metals and semiconductors; surface reactions in liquid media; and surface reactions in gaseous media. ***Harry C. Gatos, editor.*** 526 pp. 1960. John Wiley & Sons, New York. (QD506 EL25s)

Technical Proceedings of the Forty-Seventh Annual Convention, American Electroplaters' Society, July 24-28, 1960. A record of the technical papers presented, and the discussion that attended the delivery thereof, at the Annual Convention in Los Angeles, Calif. 260 pp. 1960. American Electroplaters' Society, Inc., Newark, N. J. (TS670 Am35p Vis.)

New Data on the Performance of Nickel and Chromium Plated Zinc Die Castings. Data presented demonstrate that the endurance of electroplated zinc die castings can be markedly improved with any one of three composites having minimum plate thicknesses as follows: copper–0.3 mil, duplex nickel–1.2 mils, and chromium–0.01 mil; copper–0.3 mil, duplex nickel–0.8 mil, and crackfree chromium–0.03 to 0.05 mil; and copper–0.3 mil, bright nickel–0.8 mil, and microcracked chromium–0.1 to 0.15 mil. ***W. H. Safranek, H. R. Miller, R. W. Hardy, and C. L. Faust.*** Paper from "Technical Proceedings of the Forty-Seventh Annual Convention, American Electroplaters' Society, July 24-28, 1960", p. 96-104, 1960. American Electroplaters' Society, Inc., Newark, N. J. (TS670 Am35p Vis.)

* **Inhibition of Electrochemical Reactions in Amalgam Electrodes and Isotherms of Adsorption of the Inhibitor.** The dependence of the exchange current density of electrochemical reactions on the degree of masking of the electrode surface is tested with inhibitor molecules on Hg electrodes. Under the existing conditions in the proximity of the equilibrium of the redox reaction, there are simple relatonships between inhibition and isotherms of adsorption of the inhibitor. This permits conclusions about the mechanism of the inhibitor and the potential dependence of the isotherms of molecular adsorption. (*In German.*) Inhibition elektrochemischer Reaktion an

Amalgamelektroden und Adsorptionsisotherme des Inhibitors. ***W. Müller and W. Lorenz.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 27, nos. 1-2, Jan. 1961, p. 23-33.

Fuel Cells Based on Nuclear Reactors. ***T. A. Ciarlariello and R. C. Werner.*** *Chemical Engineering Progress*, v. 57, Mar. 1961, p. 42-45.

The Prevention of Silver Tarnishing. Silver tarnishing can be overcome effectively by electrolytic treatment. Two different processes were found practical. The one employs cataphoretic deposition of an oxide layer, the other electrolytic chromating. Details of the operating conditions and results are given. ***Heinz W. Dettner.*** *Plating*, v. 48, Mar. 1961, p. 285-287.

* **The Complex Activity Theory.** The activity of electrolytic solutions is usually expressed by complicated formulas in the case of high concentration or of incomplete dissociation. Extension of the Debye and Hückel theory suggests a simplification by introducing the new concept of the angle of activity. Thus it becomes possible to represent the properties of the incompletely dissociated electrolytes by a so-called "complex" activity, whose properties are given, and to give the coefficient of activity a simple expression in the case of solutions of strong electrolytes with average concentrations. (*In French.*) Théorie de l'activité complexe. ***Florent Heitz.*** *Journal des Recherches du Centre National de la Recherche Scientifique*, no. 53, Dec. 1960, p. 263-293.

Interpretation of Experimental Characteristics of Cesium Thermionic Converters. Two different kinds of V-I curves have been obtained from a 150-w cesium thermionic converter. These are explained. ***E. N. Carabateas, S. D. Pezaris, and G. N. Hatsopoulos.*** *Journal of Applied Physics*, v. 32, Mar. 1961, p. 352-358.

* **Electrolytes for the Polishing and Etching of Austenitic Chromium-Nickel Steel and Manganese Steel.** Three electrolytes which are free of perchloric acid have been developed for the electrolytic polishing and etching of austenitic chromium-nickel steel and manganese steel. (*In German.*) Elektrolyte zum Polieren und Ätzen von austenitischen Chrom-Nickel-und Mangan-Stählen. ***Guido Bassi.*** *Zeitschrift für Metallkunde*, v. 52, Feb. 1961, p. 141-142.

Chemistry of Thermoelectric Materials. The quest for new materials to produce more efficient thermoelectric devices–now being used on a limited scale for cooling and power generation. ***Paul E. Snyder.*** *Chemical & Engineering News*, v. 39, no. 11, Mar. 13, 1961, p. 102 + 8 pages.

ELECTRONICS

ESSEX: A New Concept in Telephone Communications. This experimental system uses time-divided switching and transmission to integrate, for the first time, both major operations involved in communication between two telephones. ***W. A. Malthaner.*** *Bell Laboratories Record*, v. 39, Feb. 1961, p. 43-47.

Mechanical Waveguides. Covers the propagation of acoustic and ultrasonic waves in fluids and solids with boundaries. ***Martin Redwood.*** 300 pp. 1960. Pergamon Press, New York. (QA927 R24m)

Linear Graphs and Electrical Networks. The theory of linear graphs demonstrating the power of these methods in solving network problems. Establishes a solid mathematical foundation for electric network theory, particularly those formulations applicable to digital computers. ***Sundaram Seshu and Myril B. Reed.*** 315 pp. 1961. Addison-Wesley Publishing Co., Inc., Reading, Mass. (TK3226 Se71Lg)

* **Measurements on Parameters of Transistor Quadripoles.** The principal circuits for measurements on (complex) y and h parameters in base and emitter networks are described. All methods spring from zero methods, and their accuracy depends on the dimensions of the networks and on the sensitivity of the indicators; in general, it may be made very great. (*In German.*) Zur Messung von Transistorvierpolparametern. ***R. Paul.*** *Nachrichtentechnik*, v. 11, no. 1, Jan. 1961, p. 8-12.

* **Effect of Antenna Radiation Angles Upon HF Radio Signals Propagated Over Long Distances.** Much of the time, hourly median signal levels received on antennas with radiation angles less than 2 degrees exceeded those received at angles of 15° by 10 decibels while signals received at angles between 2 and 5° were 5 decibels greater than those received at 15 degrees. ***W. F. Utlaut.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 65D, no. 2, Mar.-Apr. 1961, p. 167-174.

* **Graphic Method to Design Profiles of Aplanatic Antennas.** Describes a simple method to develop image and lens antennas meeting the Abbe sine condition. It is based on geometrical optics methods similar to the well known method of designing mirrors with a special form diagram. The results obtained in the experimental investigation of a maquette of two-mirror aplanatic antenna are mentioned. (*In Russian.*) Graficheskiĭ metod postroeniia profileĭ aplanaticheskikh antenn. ***N. G. Ponomarev.*** *Radiotekhnika i Elektronika*, v. 6, no. 2, Feb. 1961, p. 214-220.

* **A Teflon Microwave Window.** The development of a method for the bonding of Teflon led to the use of this excellent dielectric in a new, inexpensive microwave pressure-resistant window. ***Asaf A. Benderly and Timothy J. Kilduff.*** *Microwave Journal*, v. 4, Mar. 1961, p. 101-106.

* **A Circularly Polarized Slot Antenna.** An antenna design which allows circular polarization to be realized in a rectangular slot by the simple process of placing a tilted parasitic dipole in the plane of the aperture. A theory of operation is presented along with experimental results on a dipole-slot antenna. ***E. J. Wilkinson.*** *Microwave Journal*, v. 4, Mar. 1961, p. 97-100.

* **Waveguide Components—A Survey of Methods of Manufacture and Inspection.** Techniques which are at present used in the manufacture of microwave components of wevguide form, and some guidance and discussion on methods of inspection of these components. ***D. J. Doughty.*** *British Institution of Radio Engineers, Journal*, v. 21, Feb. 1961, p. 169-189.

Experiments With a Slope-Feedback Coder for Television Compression. Experiments with a slope-feedback variable-velocity-scanning method for compressing the bandwidth of television signals are described. The test conditions were intended to demonstrate the method under favorable conditions and one test-pattern of moderate complexity. ***M. P. Beddoes.*** *IRE Transactions on Broadcasting*, v. BC-7, no. 2, Mar. 1961, p. 12-28. (TK1 In6.6bt Vis.)

* **Initial Results of a New Technique for Investigating Sferic Activity.** The technique pertains largely to spectral and directional measurements. Representative samples of data are presented and discussed. ***G. Hefley, R. H. Doherty, and R. F. Linfield.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 65D, no. 2, Mar.-Apr. 1961, p. 157-166.

* **Fresnel Region Fields of Circular Aperture Antennas.** Instead of using the conventional truncated power series expansion approximation, the Newton's iteration formula for square root is used. ***Ming-Kuei Hu.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation*, v. 65D, no. 2, Mar.-Apr. 1961, p. 137-147.

An Analysis and Representation of Junction Transistors in the Saturation State. Three diffusion processes are used to analyze the transistor behavior in Region III. This leads to a new equivalent circuit representation which is a superposition of the active-state and saturation-state models. ***Z. Wiencek.*** *IRE Transactions on Electron Devices*, v. ED-8, no. 1, Jan. 1961, p. 87-95. (TK1 In6.6ed Vis.)

RF Sensors Best for Space Probing. Probe-borne sensors are especially useful in detecting weak RF emissions and determining wave propagation characteristics in space. ***Vladimir Honeiser, Jerome Kraus, and Philip Godfrey.*** *Space/Aeronautics*, v. 35, no. 2, Feb. 1961, p. 120-124.

IR Horizon Sensor Guides Planetary Orbiting. By detecting the earth's thermal profile against the relatively weaker space radiation background, a pair of properly oriented self-contained IR horizon sensors provide the Mercury vehicle with an automatic reference for attitude control. ***Bernard Kovit.*** *Space/Aeronautics*, v. 35, no. 2, Feb. 1961, p. 131-133.

Waveguide Equipment for 2 mm Microwaves. I. Components. Special equipment for the measurement of frequency, phase, power, absorption and reflection coefficient in the microwave region. ***C. W. van Es, M. Gevers, and F. C. de Ronde.*** *Philips Technical Review*, v. 22, no. 4, 1960/61, p. 113-125.

Mode Conversion in Metallic and Helix Waveguide. Generalized telegraphist's equations describe propagation in an imperfect helix waveguide with coupling between the many propagating waves. ***H. G. Unger.*** *Bell System Technical Journal*, v. 40, no. 2, Mar. 1961, p. 613-626.

* **The Bootstrap Amplifier. Low-Frequency Response Characteristics.** ***W. Tusting.*** *Electronic Technology*, v. 38, Jan. 1961, p. 27-31.

Pulsed Millimeter-Wave Generation Using Ferrites. Low-loss garnets are used in the uniform precessional mode to store energy at S band and radiate at a higher frequency, which is controlled by the total magnetic field. ***B. J. Elliott, T. Schaug-Pettersen, and H. J. Shaw.*** *IRE Transactions on Microwave Theory and Techniques*, v. MTT-9, no. 1, Jan. 1961, p. 92-94.

* **Theoretical Study of Non-Reciprocal Resonant Isolators.** The forward and reverse attenuations and bandwidth are derived for the full-height thin silver of ferrite and attention is drawn to the significant dielectric-loss term. The theory includes second-order terms of ferrite thickness and an example is given to indicate the range of validity of the thin-silver approximation. ***J. B. Davies.*** *Philips Research Reports*, v. 15, no. 5, Oct. 1960, p. 401-432.

Long Arm: Promising 5000-Mile HF Communications System. Quantized frequency modulation is the design feature of a developmental long-range digital HF system that promises to fill a long-standing need—reliable communications over long distances despite man-made and natural interference and propagation anomalies. ***L. E. Morgan and J. S. Flatz.*** *Space/Aeronautics*, v. 35, no. 2, Feb. 1961, p. 135 + 5 pages.

* **The Theory of Waveguides and Cavities. I. A General Approach to the Exact Theory of Waveguides and Cavities.** The mathematics is not given in detail, but the difficulties encountered in setting up the mathematical problem for a given physical situation, and the physical principles involved in the treatment, are discussed. ***R. A. Waldron.*** *Electronic Technology*, v. 38, Mar. 1961, p. 98-105.

Design Data for Band-Pass Ladder Filters Employing Ceramic Resonators. Design feasibility data for a variety of networks are examined and given in the form of graphs with exact design data as tables. ***R. C. V. Macario.*** *Electronic Engineering*, v. 33, Mar. 1961, p. 171-177.

* **Design Relations for Resonant Post Waveguide Filters.** Results show that this design procedure is quite adequate for most engineering applications. ***Robert D. Wanselow.*** *Franklin Institute, Journal*, v. 271, no. 2, Feb. 1961, p. 94-107.

Traveling-Wave Parametric Amplifier Analysis Using Difference Equations. A second-order difference equation is derived for both periodically and uniformly distributed parametric amplifiers. ***H. Zucker.*** *I.R.E. Proceedings*, v. 49, Mar. 1961, p. 591-598.

* **The Phase Variation of Very-Low-Frequency Waves Propagated Over Long Distances.** Describes the relative phase variations over a pair of adjacent paths. ***B. G. Pressey, G. E. Ashwell, and J. Hargreaves.*** *Institution of Electrical Engineers, Proceedings*, v. 108, pt. B, no. 38, Mar. 1961, p. 214-226.

ENGINEERING ECONOMICS

* **Productivity Records Lead to Better Crew Management, Performance.** Knowledge of time use helps gage correct crew sizes for specific jobs, pinpoints training needs, and helps evaluate equipment used in line work. ***C. E. Monfort, Jr.*** *Electric Light and Power*, v. 39, no. 6, Mar. 15, 1961, p. 60 + 3 pages.

Our Challenge in World Markets. To be successful in world markets, managers must recognize the rapid pace of change in the world today and adjust themselves to it. *Steel*, v. 148, Mar. 13, 1961, p. 87-90.

* **More Incentives for Workers—More Profit for Foundries.** One road to lower labor costs is better wage-incentive administration. Whether production volume is high or low, foundrymen seeking profit improvement will find an adequate plan pays dividends. ***John R. Walley.*** *Modern Castings*, v. 39, Mar. 1961, p. 42-45.

When Unfair Shares Mean Bigger Shares. In his concluding article, the author discusses the differing effects of a high bank rate on the economics of the United Kingdom and of Germany. ***Jossleyn Hennessy.*** *Engineering*, v. 191, Mar. 17, 1961, p. 386.

* **Energy for the World's Needs.** At present rates of economic and population growth, about 30 times the present annual energy requirements will be needed in 100 years' time to support a trebled population with a very high average standard of living. The power can be provided from known energy resources but the main problem will be to harness them and to do so economically. ***L. Rotherham.*** *Contemporary Physics*, v. 2, no. 2, Dec. 1960, p. 81-92.

A Survey of the Petroleum Industry in Canada, 1959. ***R. A. Simpson, D. M. Nowlan, and D. W. Rutledge.*** *Canada, Mines Branch, Mineral Information Bulletin MR* 48, 1961, 82 pp. (TN26 C16.55m Contin.)

Survey of the Primary Zinc Industry in Canada, 1959. ***D. B. Fraser.*** *Canada, Mines Branch, Mineral Information Bulletin MR* 43, 1960, 84 pp. (TN26 C16.55m Contin.)

How Fast Is Red China Moving? Analyzes conflicting reports on the industrial growth of Red China. ***Tom Campbell.*** *Iron Age*, v. 187, no. 17, Apr. 27, 1961, p. 74-75.

* **Russia's Industrial Complex. How Big Is It?** Based on unclassified U. S. and Soviet sources, here is an analysis of Russia's vaunted new industrial might, classified by industry. As yet incomplete (it is a continuing project undertaken as a hobby by a U.S. engineer), this preliminary report nevertheless provides an insight into Soviet plant capacity, products and production goals in a variety of metal-working industries. ***R. W. Wallace.*** *American Machinist*, v. 105, Apr. 17, 1961, p. 116-117.

Five Years of Nuclear Power. Commemorates the Fifth Anniversary of the founding of the First Atomic Power Station at Obninsk, Russia, in June, 1954. ***N. A. Dollezhal' and A. K. Krasin.*** *Reactor Science*, v. 13, nos. 3-4, Jan. 1961, p. 189-193.

Our Pressure From Idle Capacity. Running below capacity is the single factor that's most detrimental to price—and profit—stability. *Steel*, v. 148, Apr. 24, 1961, p. 105-108.

FLUID MECHANICS

* **Hydromagnetic Flow in a Circular Pipe.** Found that the velocity profile of the liquid transforms itself from a parabola into a plateau as a magnetic field of greater strength is applied. ***K. P. Chopra.*** *Zeitschrift für Physik*, v. 162, no. 1, 1961, p. 46-52.

Motion of an Impurity Particle in a Boson Superfluid. The problem of the low-lying spectrum of a system of many bosons and one impurity particle interacting by repulsive, central, two-body forces is treated by first eliminating the dynamical variables of the impurity in terms of an added effective boson-boson interaction, and then treating the boson system by an extension of Bogolubov's method. ***M. Girardeau.*** *Physics of Fluids*, v. 4, no. 3, Mar. 1961, p. 279-291.

Turbulent Newtonian Flow in Annuli. A Prandtl mixing-length approach is applied to give a friction factor vs. Reynolds number expression for annuli which describes tube flow and slit flow as special cases. ***Donald M. Meter and R. Byron Bird.*** *A.I.Ch.E. Journal*, v. 7, no. 1, Mar. 1961, p. 41-45.

Turbulent Diffusion in the Core of Fully Developed Pipe Flow. Summarizes an experimental study of turbulent diffusion downstream of a line source of heat. Mean temperature profiles in the core of nearly fully developed pipe flow were measured at four mean velocities. ***Lionel V. Baldwin and Thomas J. Walsh.*** *A.I.Ch.E. Journal*, v. 7, no. 1, Mar. 1961, p. 53-61.

FOOD TECHNOLOGY

Oxygen-Scavenging Packet for In-Package Deoxygenation. The stoichiometric relationships, and implications of OxyBan as a substitute for vacuum and gas packing are discussed. ***Don Scott and Frank Hammer.*** *Food Technology*, v. 15, Feb. 1961, p. 99-104.

Gamma Radiation in the Control of Decay in Strawberries, Grapes, and Apples. ***Louis Beraha, G. B. Ramsey, M. A. Smith, W. R. Wright, and Fred Heiligman.*** *Food Technology*, v. 15, Feb. 1961, p. 94-98.

Recent Developments in Foam-Mat Drying. The foam-mat method has been made more practical by improvement in methods of foam stabilizing and by an improved drying technique. Promising applications include orange, tomato, pineapple, potato, baby foods, whole milk, coffee, apricot and prune purees, apple sauce, and instant carbohydrate products. ***A. I. Morgan, R. P. Graham, L. F. Ginnette, and G. S. Williams.*** *Food Technology*, v. 15, Jan. 1961, p. 37-39.

Dehydrofrozen Apples: Recent Developments in Processing Methods. ***M. E. Lazar, E. O. Chapin, and G. S. Smith.*** *Food Technology*, v. 15, Jan. 1961, p. 32-36.

Experimental Preservation of Fresh Beef With Antibiotics and Radiation. The application of 7 ppm of chlortetracycline to the surface of beef followed by irradiation with 0.1 megarad resulted in more effective inhibition of microbial growth during storage at 34 F for 30 days than the independent use of antibiotic and radiation. The useful limits of chlortetracycline concentration are 0.5 to 10 ppm and the most suitable radiation dose is 200 kilorads. Tetracycline and oxytetracycline were also effective. ***A. W. Phillips, et al.*** *Food Technology*, v. 15, Jan. 1961, p. 13-15.

Increasing Cooling Rates Through Thermal Radiation. Cooling time for material in black, nonreflective containers is 20 to 25% less than the cooling time for material in reflective containers. ***S. E. Charm and B. S. Chung.*** *Food Technology*, v. 15, Jan. 1961, p. 4-5.

The Large-Scale Production of Protein From Leaf Extracts. Juice from fresh, pulped leaves is freed from most of the starch grains, fiber and detritus, and coagulated quickly with steam. The protein coagulum is filtered off, washed with water at pH 4 and pressed into blocks with 30-40% dry matter. In this form it keeps under refrigeration. ***J. E. Morrison and N. W. Pirie.*** *Journal of the Science of Food and Agriculture*, v. 12, Jan. 1961, p. 1-5.

Leaf Protein Concentrates. I. Effect of Source of Raw Material and Method of Drying on Protein Value for Chicks and Rats. II. The Value of a Commercially Dried Product for Newly-Weaned Pigs. Provided that the method of drying did not involve high temperatures, products were all of uniformly high value, being similar to soya-bean meal as protein sources. When drying was carried out in a forced-draft oven, the temperature zone within which there was damage to the nutritive value of the protein was 82 to 94°. I. ***J. Duckworth and A. A. Woodham.*** II. ***J. Duckworth, W. R. Hepburn, and A. A. Woodham.*** *Journal of the Science of Food and Agriculture*, v. 12, Jan. 1961, p. 5-20.

* **Antibiotics in Milk—A Review. II. Methods for Detection of Antibiotics in Milk.** ***E. H. Marth.*** *Journal of Milk and Food Technology*, v. 24, Mar. 1961, p. 70-82.

Advances in Food Research. ***C. O. Chichester, E. M. Mark, and G. F. Stewart, editors.*** v. X. 488 pp. 1960. Academic Press, New York. (TP370 Ad95 Vis.)

Preservation of Fish and Shellfish by Relatively Low Doses of Beta Radiation and Antibiotics. ***Peter A. Lerke, Lionel Farber, and Wolfgang Huber.*** *Food Technology*, v. 15, Mar. 1961, p. 145-152.

Lipid Oxidation in Pre-Cooked Beef Preserved by Refrigeration, Freezing, and Irradiation. Antioxidant combinations of ascorbate and polyphosphate, used either as dips or as cover solutions, eliminate lipid oxidation and greatly improve the odor of refrigerated and frozen beef, but do not benefit irradiated beef. ***Pi-Yu Chang, Margaret T. Younathan, and Betty M. Watts.*** *Food Technology*, v. 15, Mar. 1961, p. 168-171.

Wheat Gliadin in Foams for Food Products. ***C. E. McDonald and J. W. Pence.*** *Food Technology*, v. 15, Mar. 1961, p. 141-144.

The Chemistry and Technology of Edible Oils and Fats. Proceedings of a conference arranged by Unilever Limited at Research Department, Port Sunlight, Mar. 10-12, 1959. ***J. Devine and P. N. Williams, editors.*** 154 pp. 1961. Pergamon Press, New York. (TP671 D49c)

* **Minerals and Proximate Composition of Organ Meats.** ***H. T. Hopkins, E. W. Murphy, and D. P. Smith.*** *American Dietetic Association, Journal*, v. 38, Apr. 1961, p. 344-349.

Symposium on Radioactive Fallout in Relation to Foods. *Journal of Agricultural and Food Chemistry*, v. 9, Mar.-Apr. 1961, p. 90-126.

* **Glycine Need of the Chick Fed Casein Diets and the Glycine, Arginine, Methionine and Creatine Interrelationships.** ***Howard N. Waterhouse and H. M. Scott.*** *Journal of Nutrition*, v. 73, no. 3, Mar. 1961, p. 266-272.

* **Amino Acid Balance and Imbalance. VI. Growth Depressions From Additions of Amino Acids to Diets Low in Fibrin.** ***U. S. Kamta, L. G. Elias, and A. E. Harper.*** *Journal of Nutrition*, v. 73, no. 3, Mar. 1961, p. 229-235.

FUELS AND COMBUSTION

* **Gasification of Fuel Oil at High Pressure.** Prospects for development are discussed, particularly in light of need for better gasification processes for use in power generation cycles which combine a pressurized gasifier with a supercharged boiler. Such cycles offer both improved thermal efficiency and solution of the power industry's air-pollution problems. ***Arthur M. Squires.*** *TVF. Teknisk-Vetenskaplig Forskning*, v. 32, no. 1, 1961, p. 19-26.

A New Method for the Determination of Undissolved Water in Fuels. ***L. Gardner and George Topol.*** *Materials Research & Standards*, v. 1, Feb. 1961, p. 112-115.

* **The Use of Natural Gas to Fire Ceramic Products.** In the field of ceramics and in particular for tunnel kilns in which the temperature curves and atmospheres that are sometimes reducing and sometimes oxidizing must be strictly respected, natural gas permits a great flexibility in the method of heating. (*In French.*) L'emploi du gaz naturel pour la cuisson des produits ceramiques. ***P. Leblanc.*** *Société Française de Céramique, Bulletin No.* 49, Oct.-Dec. 1960, p. 3-10.

* **Modern Methods of Obtaining Very High Temperatures.** (*In French.*) Methodes modernes d'obtention de tres hautes temperatures. ***Robert Collongues.*** *Société Française de Céramique, Bulletin No.* 49, Oct.-Dec. 1960, p. 37-50.

* **A Continuous Process for Low Temperature Fluidized Carbonization of Coal.** Preheated air is used as the fluidizing medium, and the heat for carbonization is obtained by combustion of a part of the coal and char inside the carbonizer, which is electrically heated. ***S. K. Mukherjee, M. Sen, A. K. Das Gupta, and A. Lahiri.*** *Journal of Scientific & Industrial Research*, v. 19A, Dec. 1960, p. 611-615.

Methylene Radicals and Thermal Gas Phase Decomposition of Diazomethane. ***B. S. Rabinovitch and D. W. Setser.*** *American Chemical Society, Journal*, v. 83, Feb. 5, 1961, p. 750-751.

* **Liquid Fuel in the Ceramics Industry.** A ten-year review, 1948-1958. ***T. Chippindale.*** *British Clayworker*, v. 70, Mar. 1961, p. 69-74.

* **A Down-Draft Coal Gasification Pilot Plant.** Pilot plant, designed and fabricated for the study of suspension gasification of noncoking, high volatile Raniganj coals is described. ***M. Sen, et al.*** *Journal of Scientific & Industrial Research*, v. 20D, Jan. 1961, p. 4-11.

* **Flame Speeds in Oscillating Gases in a Tube.** ***K. Krishna Prasad, K. Mahadevan, and H. A. Havemann.*** *Indian Institute of Science, Journal*, v. 43, no. 1, Jan. 1961, p. 26-43 + 2 plates.

Preflame Reactions in the Autodecomposition of Acetylenic Compounds. ***U. V. Henderson, Jr.*** *Journal of Physical Chemistry*, v. 65, Feb. 1961, p. 309-313.

* **Explosion Limits of Liquid Systems Containing Hydrogen Peroxide, Water, and Oxygenated Organic Compounds.** Tests applied show clearly that steady detonations can occur in limited regions of concentrations of the three components. In other regions, rapid deflagrations can be initiated. A greater region of concentrations is nonexplosive. ***J. M. Monger, Harry Sello, and D. C. Lehwalder.*** *Journal of Chemical and Engineering Data*, v. 6, no. 1, Jan. 1961, p. 23-27.

* **Tonsteins: A Possible Additional Aid to Coalfield Correlation.** Reviews foreign literature describing tonsteins. These thin bands of koalinitic rock, generally found intercalated in coal seams are important in coal measure correlation. ***Iain A. Williamson.*** *Mining Magazine*, v. 104, no. 1, Jan. 1961, p. 9-14.

Low-Temperature Flow Properties of Residual Fuel Oil: Report of IP Fuel Oil Flow Panel. Reviews work to devise a laboratory test for predicting the lowest temperature at which a residual fuel oil in normal commercial storage may be pumped or otherwise moved at an economical rate under typical conditions of handling in practice. *Institute of Petroleum, Journal*, v. 47, Feb. 1961, p. 57-73.

* **Sulphur-Free Fuels for Kiln Firing.** Liquified petroleum gases are today accepted as an alternative fuel for both continuous and intermittent furnaces. *Ceramics*, v. 12, Jan. 1961, p. 22-23.

Handling and Hazards of Propellant Fuels. ***H. A. Volz.*** *Industrial and Engineering Chemistry*, v. 53, Mar. 1961, p. 69A + 2 pages.

Combustion Nuclei—An Index for Classifying Gaseous Hydrocarbon Fuels. ***J. E. Quon, B. D. Tebbens, and J. F. Thomas.*** *Industrial and Engineering Chemistry*, v. 53, Mar. 1961, p. 235-238.

Utilization of Solar Energy. ***Farrington Daniels.*** 14 pp. 1960. American Society for Testing Materials, Philadelphia, Penna. (TJ810 D22u)

* **Burning Velocities of Hydrogen-Air and Hydrogen-Oxygen Mixtures. Determination by Burner Method With Schlieren Photography.** A Schlieren system for photographing the inner cone in bunsen flames used in burning velocity measurements is described. A useful magnification factor of 20 to 25 times measured from the burning cone to its photograph is obtainable. ***D. A. Senior.*** *Combustion and Flame*, v. 5, no. 1, Mar. 1961, p. 7-10.

* **Thermal Radiation From Fluorine-Ammonia Flames.** The radiation from stoichiometric fluorine-ammonia flames has been measured at atmospheric pressure and at two optical densities. ***R. Eulner, J. Mertens, and R. L. Potter.*** *Combustion and Flame*, v. 5, no. 1, Mar. 1961, p. 1-5.

Kinetics of Hydrogen Oxidation Downstream of Lean Propane and Hydrogen Flames. ***Burton Fine.*** *Journal of Physical Chemistry*, v. 65, Mar. 1961, p. 414-417.

* **Fuel Technology in the U.S.S.R.** Energy reserves are given including coal, peat, oil, and natural gas reserves. Mining methods, carbonization, and coal preparation are outlined. ***W. Idris Jones.*** *Institute of Fuel, Journal*, v. 34, Mar. 1961, p. 94-98.

Steam-Oxygen Gasification of Fine Sizes of Coal in a Fluidised Bed at Elevated Pressure. I. Reaction of Carbon With Hydrogen. II. Reaction of Carbon With Steam. III. Relation of Integral to Differential Rates; Effect of Carbon Level on Gasification Rate, and Role of the Shift Reaction. ***Arthur M. Squires.*** *Institution of Chemical Engineers, Transactions,* v. 39, no. 1, 1961, p. 3-27.

Design of Experiments on the Kinetics of the Water-Gas Shift Reaction. ***Hugh M. Hulburt and C. D. Srini Vasan.*** *A.I.Ch.E. Journal,* v. 7, no. 1, Mar. 1961, p. 143-147.

* **Flow Round a Plate by a Gas Burning on Its Surface.** An analysis is made of various surface conditions, and the corresponding velocity, temperature and concentration contours in the boundary layer. The case considered is more general than the one discussed earlier of ignition during flow by an incompressible liquid. (*In Russian.*) Obtekanie plastiny gazom, goriashchim na ee poverkhnosti. ***L. Iu. Artiukh, L. A. Vulis, and V. P. Kashkarov.*** *Inzhenerno-Fizicheskĭ Zhurnal,* v. 4, no. 3, Mar. 1961, p. 39-45.

* **The Reactivity of Coke and Its Study.** Connects directly with the chemical kinetics of the heterogeneous reactions whose purpose is the determination of the rates of reaction and of the parameters governing it. These parameters were analyzed in the special case where the solid phase consists of a porous body subjected to the experimental conditions existing in industrial practice. A working method and an experimenting apparatus was developed. (*In French.*) La réactivité du coke et son étude. ***E. Grand'ry and H. Renson.*** *Revue Universelle des Mines,* v. 17, ser. 9, Mar. 1961, p. 73-98.

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

* **Navy's Sugar Grove Radio Telescope—Space Station in the Wilderness.** Pictorial description of the installation. *American Engineer,* v. 31, Mar. 1961, p. 30-32.

* **Radio-Wave Propagation in the Earth's Crust.** The electrical conductivity of the basement rock has not been explored. An example based on reasonable estimates indicates that transmission at 1.5 kc/s might be possible for a distance of the order of 1500 km. ***Harold A. Wheeler.*** *U. S. National Bureau of Standards, Journal of Research, Section D, Radio Propagation,* v. 65D, no. 2, Mar.-Apr. 1961, p. 189-191.

Symposium: Cosmochemistry. A symposium of four papers by several authors. *Journal of Chemical Education,* v. 38, Feb. 1961, p. 52-82.

* **Stratospheric Aerosols.** Information was obtained on the vertical profiles as a function of particle size, on the size distribution of these particles and on their physical structure and chemical composition. ***Christian E. Junge, Charles W. Chagnon, and James E. Manson.*** *Journal of Meteorology,* v. 18, no. 1, Feb. 1961, p. 81-108.

* **New Radio Reflection Method Finds Oil and Gas Directly.** The abrupt differenecs between the electrical characteristics of hydrocarbons and salt water provide the distinction between an oil and/or gas accumulation and other natural occurrences in a sedimentary section. ***Harrison T. Brundage.*** *World Oil,* v. 152, Mar. 1961, p. 54-57.

* **How to Use Foaming Agents in Air and Gas Drilling.** These agents aid in decreasing borehole pressure, increasing penetration rate in presence of water, preventing balling of cuttings, and removing cuttings. ***W. C. Goins, Jr. and H. J. Magner.*** *World Oil,* v. 152, Mar. 1961, p. 59-64.

* **The Dolphins' Secret.** A theoretical discussion of hydraulic principles. ***Max O. Kramer.*** *American Society of Naval Engineers, Journal,* v. 73, no. 1, Feb. 1961, p. 103-107.

* **New Beryllium Discoveries on Colorado's Badger Flats.** ***Jesse Simmons.*** *Mining World,* v. 23, no. 3, Mar. 1961, p. 28-30.

* **Symposium on the Chemical Approaches to the Recognition of Petroleum Source Rocks.** Five of the seven papers presented are published here as a group. ***William E. Hanson, editor.*** *Geochemica et Cosmochimica Acta,* v. 22, no. 1, Feb. 1961, p. 1-64.

* **Thermal Oil Recovery Experiment in the Pennsylvania Middle District Producing Area.** ***N. A. Caspero, W. T. Wertman, and Q. E. Wood.*** *Producers Monthly,* v. 25, no. 2, Feb. 1961, p. 27-28.

Design Criteria for Portable Seismographs. ***Wilbur I. Duvall.*** *U. S. Bureau of Mines Report of Investigations* 5708, 1961, 6 pp. (TN21 Un3r Room 290)

* **The Measurement of Atmospheric Temperature.** The theory of air-temperature measurement at pressures between 1000 mb and 1 mb is discussed on the basis of the classical approach to heat-transfer problems. ***Edward P. Ney, Raymond W. Maas, and William F. Huch.*** *Journal of Meteorology,* v. 18, no. 1, Feb. 1961, p. 60-80.

* **Experimental Drilling Will Test Techniques and Equipment for Project Mohole.** *Mines Magazine,* v. 51, Feb. 1961, p. 12 + 1 page.

Tools of the Astronomer. Provides a guide to the instruments employed in astronomical research. Techniques and instruments that are finding extensive application in the field of astronomy today are discussed, such as photography, the optics and coating techniques of lenses and mirrors, telescope mounts and drives, instrumentation for photometric and spectroscopic work, for solar research, and radio telescopes. ***G. R. Miczaika and William M. Sinton.*** 294 pp. 1961. Harvard University Press, Cambridge, Mass. (QB88 M58t)

A Cosmological Theory of the Solar System. A Four-Dimensional Approach. Investigates the hypothesis that our three-dimensional universe, which appears to extend indefinitely in all directions, is really finite but derives its apparently infinite size from curvature in a four-dimensional space, in the same way that the two-dimensional surface of a sphere owes its lack of a boundary to curvature in the third dimension. ***Bertrand A. Landry.*** *Main Currents in Modern Thought,* v. 17, no. 3, Jan.-Feb. 1961, p. 59-61.

* **Comparison of a Familiar Formula for Speed of Sound in Sea Water With the Kuwahara-Mackenzie Formula.** ***F. E. Bellas.*** *Acoustical Society of America, Journal,* v. 33, Feb. 1961, p. 249.

* **Energy and Numerical Weather Prediction.** It is often desirable that simplified equations conserve total energy under reversible adiabatic processes. Preferably, the equations should also conserve the sum of kinetic energy and available potential energy, and they should describe the tendency for static stability to increase as kinetic energy is released. ***Edward N. Lorenz.*** *Tellus,* v. 12, no. 4, Nov. 1960, p. 364-373.

* **The Dynamics of Flow on a Submarine Ridge.** Equations of motion are developed in a form appropriate to flow parallel to a uniformly sloping bottom. Some general conclusions, which are relevant to the interpretation of observational data, are drawn. ***K. F. Bowden.*** *Tellus,* v. 12, no. 4, Nov. 1960, p. 418-426.

* **On the Temperature and Humidity Dependence of the Ice Forming Activity of Silver Iodide.** ***Ulrich Katz.*** *Zeitschrift für Angewandte Mathematik und Physik,* v. 12, no. 1, 1961, p. 76-79.

Meterological Satellite Systems in Weather Research and Services. Hurricane, cyclone, tornado, typhoon? Tiros cloud photographs fill in many serious gaps in our observation and measurement of the atmosphere. ***F. W. Reichelderfer.*** *Aero/Space Engineering,* v. 20, Mar. 1961, p. 22 + 8 pages.

* **Investigations of the Wash-Out Effect in the Lower Atmosphere.** At a mountain station and at a valley station in the Bavarian Alps, measurements of the fission product radioactivity in air and precipitation, of the natural radioactivity in air, and of the concentration of aerosol particles were carried out synchronously and continuously. (*In German.*) Untersuchungen über den wash out-Effekt in der unteren Atmosphäre. ***R. Reiter.*** *Atomkernenergie,* v. 6, Feb. 1961, p. 68-74.

* **Reactivity of Sodium and Lithium at a High Altitude.** Determination of the time constant of disappearance of sodium and lithium at the altitude of 190 kms from the D_2/D_1 ratio of the resonance lines emitted by man-made alkali clouds. (*In French.*) Réactivité du sodium et du lithium dans la haute atmosphère. ***J. Blamont and M. L. Lory.*** *Annales de Géophysique*, v. 16, no. 4, Oct.-Dec. 1960, p. 435-444.

* **Microseismic Storms Observed on the West Coast of Africa.** The M'Bour Observatory often registers microseismic storms with sudden beginning and short periods (0.5 to 2 sec), they are correlated with squalls, the path of which is nearly perpendicular to the coast. These microseims originate in shallow water and may be due to short waves generated by gusts. (*In French.*) Apparitions de microséismes observeés sur la cote Ouest-Africaine. ***J. Metzger.*** *Annales de Géophysique*, v. 16, no. 4, Oct.-Dec. 1960, p. 565-567.

* **On the Origin of the Earth's Crust Matter. I.** Assumes that the silicate phase of the Earth—the mantle—consists of a material, whose composition is conformable to the composition of stony meteorites. The process of various meteorite formations is based on the process of agglomeration of chondrules and various larger fragments of cosmic matters, the history of which in the preplanetary stage is different. ***A. P. Vinogrador.*** *Geokhimiia*, 1961, no. 1, p. 3-29.

* **Use of Large Cavities to Reduce Seismic Waves From Underground Explosions.** The experiment, called Cowboy, was designed to test the decoupling principle by carrying out a series of eight high-explosive shots in two spheres made in a salt dome, and nine tamped shots for comparison. ***Roland F. Herbst, Glenn C. Werth, and Donald L. Springer.*** *Journal of Geophysical Research*, v. 66, no. 3, Mar. 1961, p. 959-978.

* **Influence of Sunspots on Geomagnetic Disturbance.** The hypothesis that the ejection of solar corpuscles is influenced by interactions of "active region" magnetic fields is tested empirically. The results do not support the hypothesis. ***Fred Ward and Ralph Shapiro.*** *Journal of Geophysical Research*, v. 66, no. 3, Mar. 1961, p. 739-746.

Radioactive Inert Gases as Tracers for Petroleum Reservoir Studies. Describes development and application of techniques and instruments for using radioactive inert-gas tracers to determine flow paths through petroleum reservoirs that have natural fracture systems and for which water injection has been selected as the stimulative production method. ***F. E. Armstrong, W. D. Howell, and J. Wade Watkins.*** *U. S. Bureau of Mines Report of Investigations* 5733, 1961, 15 pp. (TN21 Un3r Room 290)

Mathematical Problems in Seismology. Homogeneous and layered half-spaces are discussed. Expressions are found for the displacement caused by a point source in such models. ***W. J. Byatt and G. P. DeVault.*** *U. S. Atomic Energy Commission*, SC-4542(RR), Jan. 1961, 82 pp. (UF767 Un3.1sc Contin.)

* **Underwater Sound.** A comprehensive rundown of acoustical principles as they apply to latest ASW. ***A. N. Glennon.*** *Underwater Engineering*, v. 2, no. 2, Mar.-Apr. 1961, p. 27-28.

* **First Results of IGY Rocket and Satellite Research.** Contains some 50 papers presented at the Symposium on Rockets and Satellites held at the fifth meeting of the CSAGI in Moscow. Covers the fields of orbits and orbit computation, geodesy, atmospheric density inferred from drag accelerations, and atmospheric density, pressure, temperature, composition, and winds. ***Homer E. Newell, Jr. and Leonard N. Cormier, editors.*** *Annals of the International Geophysical Year*, v. 12, pt. 1, 1960, 459 pp.

* **Long-Range Measurement of Sound Speed in Sea Water.** ***G. R. Garrison, P. C. Kirkland, and S. R. Murphy.*** *Acoustical Society of America, Journal*, v. 33, Mar. 1961, p. 360-361.

Volcanology. Furnishes some of our best clues to the nature of the earth's interior. ***Gordon A. Macdonald.*** *Science*, v. 133, Mar. 10, 1961, p. 673-679.

* **Granite Tests New Drill Rig.** Results of drilling tests with an all-electric powered drill with rotary air compressor. ***Robert C. Alfred.*** *Rock Products*, v. 64, Mar. 1961, p. 81-83.

* **Falling Probe Electron Density Measurements.** An experiment to measure the magnitude and degree of inhomogeneity of the electron density in an auroral display. The measurement will be carried out simultaneously by three separate packages ejected from the rocket as it enters the aurora. ***P. A. Forsyth and A. Kavadas.*** *Canadian Aeronautical Journal*, v. 7, no. 3, Mar. 1961, p. 105-108.

* **Geomagnetic Micropulsations.** Simultaneous observations of geomagnetic micropulsations at three places ranging from 28°S. to 51°S. geomagnetic latitude shows that there is no observable change in the micropulsation period with latitude although there is a monotonic increase in the amplitude with latitude for all periods between 10 and 100 sec. ***G. R. A. Ellis.*** *Australian Journal of Physics*, v. 13, no. 4, Dec. 1960, p. 625-632.

Phase Relations of Miscible Displacement in Oil Recovery. Relates and compares the phase relations and mass transfer mechanisms of the various basic miscible displacement processes. ***C. A. Hutchinson, Jr. and Philip H. Braun.*** *A.I.Ch.E. Journal*, v. 7, no. 1, Mar. 1961, p. 64-72.

* **Nitrogen/Argon and Nitrogen Isotope Ratios in Aerobic Sea Water.** Various factors which influence the concentrations of gases dissolved in sea water are discussed. A surface equilibrium model is proposed, and results presented to test the model and to ascertain whether or not N dissolved in sea water is biologically and chemically inert. ***Bruce B. Benson and Peter D. M. Parker.*** *Deep-Sea Research*, v. 7, no. 4, Mar. 1961, p. 237-253.

* **Some Physico-Chemical Peculiarities of Uranium Behaviour in Hydrothermal Solutions.** (*In Russian.*) Nekotorye fiziko-khimicheskie osobennosti povedeniia urana v gidrotermal'nykh rastvorakh. ***G. B. Naumov.*** *Geokhimiia*, 1961, no. 2, p. 115-132.

Geomagnetic Field Lines in Space. New results which will assist in extending the spatial description of the distribution of the energtic geomagnetically trapped radiation such as that in the Van Allen radiation belts. ***E. H. Vestine and W. L. Sibley.*** *Rand Corporation, Report* R-368, Dec. 1960, 111 pp. (T13 R15r Contin.)

Interior of the Moon. The study of the lunar interior offers a wide field for speculation. ***Gordon J. F. MacDonald.*** *Science*, v. 133, Apr. 7, 1961, p. 1045-1050.

Narrow-Beam Echo-Ranger for Fishery and Geological Investigations. A 36 kc/s underwater acoustic echo-ranger for work on fish-detection problems, has also proved to be a valuable tool for marine geological investigations. ***M. J. Tucker and A. R. Stubbs.*** *British Journal of Applied Physics*, v. 12, Mar. 1961, p. 103-110.

GRAPHIC ARTS

Standards for Microfilm. Application of microfilm techniques to the engineering drawing field puts increased emphasis on the need for further standardization. ***Carl E. Nelson.*** *Graphic Science*, v. 3, Mar. 1961, p. 27-28.

Theoretical Considerations on the Quantum Efficiency of Photographic Detectors. Shows that statistical fluctuations in the incident photons, as well as fluctuations in the number of detectors made developable by a given exposure, preclude the possibility of achieving a quantum efficiency of unity. ***Hans J. Zweig.*** *Optical Society of America, Journal*, v. 51, Mar. 1961, p. 310-319.

Photogrammetry and Photo-Interpretation. Subject matter is of value to geologists, soil scientists, botanists, geographers, and engineers, as well as foresters. The new edition also serves all nonphotogrammetrists who use aerial photographs as a professional tool. ***Stephen H. Spurr.*** 2nd Ed. 472 pp. 1960. The Ronald Press Co., New York. (TR693 Sp95p)

Elements of Photogrammetry. Presents the fundamentals of photogrammetry and explains the planning of a flight mission, the assembly of the photographs, and the use of stereo-

scopic instruments for a metrical analysis of the photographs and for mapping. Both the vertical and the oblique photograph and combinations of them are discussed. ***Wilfred H. Baker.*** 199 pp. 1960. The Ronald Press Co., New York. (TR693 B17e)

* **Definition of the Border of the Spot of a Densitometer, the Callier Effect and the Photographic Granulation.** Presents a general formula that yields the transparency of a photographic emulsion surface. (*In French.*) Définition du contour de spot d'un densitomètre, effet Callier et granulation photographique. ***Pierre Vernier.*** *Revue d'Optique Théorique et Instrumentale,* v. 39, no. 11, Nov. 1960, p. 505-515.

New Instruments, Materials and Tools. Equipment can produce an industrial radiograph in 15 seconds. *Journal of Scientific Instruments,* v. 38, Feb. 1961, p. 65.

Artificial Aging of Latent Image in Ektacolor Paper. Heat is selected as the aging agent. Experiments are performed to find the proper temperature and exposure time. ***Ted H. Horn.*** *Society of Motion Picture and Television Engineers, Journal,* v. 70, Jan. 1961, p. 39-41.

Some Philosophical Aspects of High-Speed Photographic Instrumentation. Difficulties which arise in the analysis of rotating-mirror streak-camera records are described and the simultaneous use of associated equipment to overcome these difficulties is recommended. The need for "mental conditioning" to avoid the pitfalls of misinterpreted high-speed photographic recordings is demonstrated. The nature of the cameras, the recorded light and the physical characteristics of the events being studied must be carefully analyzed to avoid typical misinterpretations. ***Morton Sultanoff.*** *Society of Motion Picture and Television Engineers, Journal,* v. 70, Jan. 1961, p. 1-6.

* **A Note on the Possibility of Photographing a Satellite Near the Moon.** Light levels are considered with regard to the photographic requirements. Calculations are presented of the light reflected by a matt white spherical satellite near the Moon. The brightness of the image of the satellite in a photographic telescope is compared with the brightness of the image of the Moon. ***J. S. Courtney-Pratt.*** *Journal of Photographic Science,* v. 9, no. 1, Jan.-Feb. 1961, p. 36-55.

Photogrammetry. Basic Principles and General Survey. Outlines the fundamental principles of photogrammetry and illustrates the most important photogrammetric procedures used in practice. Appended data give the advanced student the theoretical principles of photogrammetry in a strict scientific manner. ***Bertil Hallert.*** 340 pp. 1960. McGraw-Hill, New York. (TA593 H15p)

* **Tone Reproduction in Offset Lithography.** Ideal contact screens for deep-etch plates are described and the effect of platemaking variables on dot size is discussed. ***V. G. W. Harrison.*** *Journal of Photographic Science,* v. 9, no. 1, Jan.-Feb. 1961, p. 1-13.

* **A Quickly Adjustable Vertical Guinier Camera.** For use with a vertical X-ray tube. All critical distances and angles are defined by exchangeable spacers that are adjustable once for all. ***H. F. Fischmeister.*** *Acta Crystallographica,* v. 14, pt. 2, Feb. 10, 1961, p. 113-115.

The Core Camera: Continuous Receptivity—One Rotating Element. Advantages of a streak camera having continuous receptivity and employing only one rotating element are discussed. The essential element of such a camera is a prism-mirror combination which is rotated at high speed. ***J. N. Whyte.*** *Society of Motion Picture and Television Engineers, Journal,* v. 70, Feb. 1961, p. 111-113.

HEAT POWER

Chemical Rocket-Propulsion Systems. Chemical propulsion; liquid and solid propellants; liquid vs solid; ducted jet propulsion; and underwater propulsion. ***F. J. Hendel.*** *Chemical Engineering,* v. 68, Mar. 6, 1961, p. 99-114.

Slotted Tube Grain Design. A mathematical analysis was made of the internal burning slotted tube configuration, which has distinct advantages for certain solid propellant applications. Those advantages are zero sliver, high loading density and thick web capability, low stress concentration, and mandrels that can be made cheaply and in a relatively short time. The central disadvantage is that an insulating liner is required to protect the motor wall in the slot region. The results of the mathematical analysis were programmed for an electronic computer, and calculations made for a wide range of the parameters of interest. These data have been prepared in graphical form for greater utility. ***Max W. Stone.*** *ARS Journal,* v. 31, Feb. 1961, p. 223-228.

Electric Engines for Power in Deep Space. Jet velocity—the speed attained by a gas leaving a rocket nozzle—is critical in spacecraft design. As a rule of thumb, higher velocities mean smaller vehicles. Generating up to 20 times the jet velocity of chemical rockets, MHD, ion, and electrothermal engines show tremendous potential for low-thrust power outside gravity fields. ***Donald Boldman.*** *Machine Design,* v. 33. Mar. 16, 1961, p. 26-28.

* **Plasma Propulsion.** ***Robert V. Hess.*** *Missile Design & Development,* Mar. 1961, p. 24-26.

* **The Effect of Fuel Distribution on Reaction Rates.** Theoretical reaction rate considerations normally require homogeneity of the mixture supply. An attempt—necessarily crude by reason of the analytical difficulties—is made here to cater for the case of nonuniform fuel distribution. Assuming a point-source injector in a parallel pipe, the "loss" in reaction rate is calculated for a limited number of specimen cases. ***M. V. Herbert.*** *Aeronautical Quarterly,* v. 12, pt. 1, Feb. 1961, p. 41-50.

Advanced Rocket Propulsion. Liquid rockets, storable liquids, hardware, solid rockets, hybrid rockets, chemical-nuclear hybrids, ducted jet propulsion, free-radical rockets. ***Frank J. Hendel.*** *Chemical Engineering,* v. 68, Apr. 3, 1961, p. 131-148.

An Improved Gasoline Antidetonant. A study of the mechanism that makes TML a more effective antiknock agent than TEL in high octane gasolines. ***W. L. Richardson, M. R. Barusch, G. J. Kautsky, and R. E. Steinke.*** *Industrial and Engineering Chemistry,* v. 53, Apr. 1961, p. 305.

* **Pressure Forces on Variable Conical Nozzles.** A theoretical study of pressure and turning moment distribution on turbojet engine reheat systems. ***W. A. Woods.*** *Aircraft Engineering,* v. 33, Apr. 1961, p. 100-102.

HUMAN FACTORS

Speaking to People Through Their Skins. Speech can be processed into vibrations that can be understood through the skin. An additional channel for passing information to people is thus available. It could be used where seeing or hearing is impaired. *Engineering,* v. 191, Mar. 24, 1961, p. 412.

Human Vigilance and Operant Behavior. The analysis of vigilance as operant behavior treats illumination (observing) responses as operants that produce signal-detections. Evidence is presented that the relationship is an artifact of the procedure, and that no vigilance factor is involved in illumination-responses. ***Harry J. Jerison and John F. Wing.*** *Science,* v. 133, Mar. 24, 1961, p. 880-881.

Dimensions for Hand Grips. To get maximum advantage from knobs and handles, suggested sizes are sketched. ***Frank William Wood, Jr.*** *Product Engineering,* v. 32, no. 15, Apr. 10, 1961, p. 64-65.

* **Training in Engineering Psychology.** Considers the nature of the scientific and professional work of psychologists and related specialists who are active in the broad fields of human factors engineering, analyzes the qualifications required for such work, and outlines training programs which should provide an adequate preparation for specialization in this area. *American Psychologist,* v. 16, Apr. 1961, p. 171-177.

INFORMATION—PREPARATION AND DISSEMINATION

The Future of Scientific Documentation. Is it still really necessary for scientists to publish their results in the specialist periodicals? The proposals made here envisage the publication of separate papers on a national basis, the international publication of titles and abstract journals, and a greater number of journals reviewing progress. ***B. K. Blount.*** *New Scientist*, v. 9, Feb. 9, 1961, p. 344-345.

Notes on the Use of Roles and Links in Coordinate Indexing. An analysis of coordinate indexing in an effort to prevent "noise" or false answers when trying to retrieve relevant information. ***Mortimer Taube.*** *American Documentation*, v. 12, no. 2, Apr. 1961, p. 98-100.

The Historical Development and Present State-of-the-Art of Mechanized Information Retrieval Systems. The last ten years of equipment development and the application of mechanization techniques are reviewed for each of several functionally separate approaches, such as punched-card systems, computer systems, and magnetic media systems. Comments are made on the progress to date and the degree of activity to be expected during the next few years for each of these approaches. ***Charles P. Bourne.*** *American Documentation*, v. 12, no. 2, Apr. 1961, p. 108-110.

Storage and Retrieval of Chemical Research and Patent Information by Links and Roles in Du Pont. The system is defined and described, and details of its historical background presented. Then, the following are discussed: indexing techniques; syntactical controls, and "grammar" in the inverted arrangement; the indexing forms or tracing sheets which have been used; the products of the indexing operation; description of the mechanical steps from tracing sheets to printed Coordinate Index; updating the system; potential of the existing system for expansion; and adaptation to patent information. ***J. C. Costello, Jr.*** *American Documentation*, v. 12, no. 2, Apr. 1961, p. 111-120.

The Formation of Abstracts by the Selection of Sentences. I. Sentence Selection by Men and Machines. II. The Reliability of People in Selecting Sentences. Auto-abstracting techniques based on high-frequency words show an extremely small variation among themselves in the selection of sentences to form abstracts. Human selection of sentences, although less variable than chance expectancy, is considerably more variable than the machine methods. There was very little agreement between the subjects and machine methods in their selection of representative sentences. Although subjects exhibited some reliability in selecting representative sentences, the resultant reliability was low. The lack of inter- and intra-subject reliability seems to imply that a single set of representative sentences does not exist for an article. It may be that there are many equally representative sets of sentences which exist for any given article. I. ***G. J. Rath, A. Resnick, and T. R. Savage.*** II. ***A. Resnick.*** *American Documentation*, v. 12, no. 2, Apr. 1961, p. 139-143.

* **Practical Information Handling.** Extensive experience with the qualitative approach to scientific information has demonstrated that it is effective in meeting the needs of both occasional and regular users by simplifying and speeding up their information-searching task. Such an approach benefits serious seekers of information because the information they use is what they selected and each person's selection is the most precise for him. The occasional user profits from the qualitative approach by virtue of selections made by the regular and more knowledgeable users. ***John W. Murdock and Gustavus B. Simpson, Jr.*** *Industrial Research*, v. 3, no. 2, Apr.-May 1961, p. 41-43.

Keeping Up With Technical Literature. An effective reading program can be achieved through a plan of selected periodical reading supplemented by use of abstracts and indexes. ***Harold S. Sharp.*** *Machine Design*, v. 33, Apr. 27, 1961, p. 113-115.

The Manipulation of Nonconventional Indexing Systems. Discusses scanning and collating systems, and extrapolating to internal storage of an index memory system. ***Fred R. Whaley.*** *American Documentation*, v. 12, no. 2, Apr. 1961, p. 101-107.

Selective Dissemination of New Scientific Information With the Aid of Electronic Processing Equipment. A service system is described in which a new document is characterized by a vocabulary or pattern of keywords. This pattern is then compared with the vocabularies or profiles characterizing each of the participants of the service. If a given degree of similarity exists between the two, the affected participants are notified by a card carrying an abstract. The recipient signifies whether the information is in fact relevant or not by returning or not returning a stub provided with the card. His affirmative response, which may include his request for a copy of the document, is reflected on his profile by incorporating the pattern of the accepted item. Profiles are kept current by discarding patterns after they have reached a certain age. The feedback includes notification of authors as to the reception of their work. The service also facilitates participants' referral of information to others and generally endeavors to promote interchange of information by personal contact. ***H. P. Luhn.*** *American Documentation*, v. 12, no. 2, Apr. 1961, p. 131-138.

INSTRUMENTATION

High Resolution Focusing Čerenkov Detector for High Energy Particles. A focusing differential Čerenkov counter of high velocity resolution using a gas radiator has been developed and used in relativistic particle beams. The optical and mechanical features are described. The velocity β can be varied continuously from 0.81 to 1.00. These counters give a velocity resolution $\Delta\beta/\beta$ of 0.0025 (half-width at half-maximum) at $\beta = 0.9985$ and an average efficiency of a 4-in. diameter particle aperture of 0.7 in a particle beam collimated to $\pm$ 1°. The sources of spurious response and the ultimate limitations of counters of this type are discussed. ***D. A. Hill, et al.*** *Review of Scientific Instruments*, v. 32, Feb. 1961, p. 111-117.

Interferometric Instrument for the Rapid Measurement of Small Diameters. The operating procedure consists of placing the test fiber between two optically flat surfaces and, using the fiber as a fulcrum, adjusting the upper flat until the surfaces are parallel and utilizing the absence of interference fringes between the surfaces to indicate parallelism. Controlled tilting of the upper flat is obtained by adjusting, with a micrometer screw, a sliding wedge under a lever attached to the upper flat. Fiber diameter is a linear function of wedge position as indicated by micrometer screw setting. ***Douglas H. Blackburn.*** *Review of Scientific Instruments*, v. 32, Feb. 1961, p. 137-139.

Device for Preparing Accurately X-Ray Oriented Crystals. Device will produce surfaces accurate to about 2′ of arc from plates that are within 5° of proper orientation. ***W. L. Bond.*** *Journal of Scientific Instruments*, v. 38, Feb. 1961, p. 63-64.

High-Pressure Measurement. The new bulk-modulus-cell high-pressure gage provides ruggedness and reliability for the ranges between 0-50,000 and 0-200,000 psi. ***Donald H. Newhall and Leonard H. Abbot.*** *Instruments and Control Systems*, v. 34, Feb. 1961, p. 232-233.

The Six-Dial Thermofree Potentiometer. Traces the evolution of the general-purpose potentiometer from the original concepts of Poggendorf, looking at the special requirements for extending the potentiometer technique into the sub-microvolt range, and examining the means employed in the Six-Dial Thermofree Potentiometer to attain a precision of 0.01 microvolt in low-voltage measurements. ***W. H. Schaeffer.*** *Instruments and Control Systems*, v. 34, Feb. 1961, p. 283-291.

An Improved pH Electrode Assembly. This modified assembly can be steam-sterilized and can be installed in steel vessels of all sizes in many ways. Its design is such that electrode life is prolonged and contamination hazards are reduced. ***J. M. West, G. P. Stickle, K. D. Walter, and W. E. Brown.*** *Industrial and Engineering Chemistry*, v. 53, Feb. 1961, p. 44A-45A.

* **A New Type of Recording Rain Gauge.** A novel feature of the instrument is a floating potential point obtained by using a wire-wound resistor and a floating (cork) point. The potential differences corresponding to different amounts of rainfall are

converted into variations of current through an Esterline-Angus recorder, using a d.c. amplifier. The floating point permits high sensitivity and detection of fine variations in the rate of rainfall, as well as recording without wetting the recording chart because of the feasibility of remote recording. ***R. Ramanadham and K. Nagamuneswara Rao.*** *Journal of Scientific & Industrial Research*, v. 19A, Dec. 1960, p. 608-610.

A Wet Test Meter for Low Flows, High Pressures. Small flows of gases can be measured accurately in the laboratory at pressures up to 1000 p.s.i.g., with recently developed small compact high-pressure wet-test meter. ***W. M. Miller.*** *Industrial and Engineering Chemistry*, v. 53, Feb. 1961, p. 127-130.

* **An Ultra Low Frequency Bridge for Dielectric Measurements.** The bridge described is capable of measuring the parallel capacitance and resistance of dielectric specimens in the frequency range of 0.008 to 200 cps. It employs no earthing device and is directly connected to a three-terminal oscillator. The substitution method is employed. The capabilities of the bridge are experimentally tested by measurements upon known capacitors and resistors, and by comparison with results obtained using a Schering bridge near 100 cps. The apparatus is capable of accuracies previously unattained at these low frequencies. ***Donald J. Scheiber.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation*, v. 65C, no. 1, Jan.-Mar. 1961, p. 23-42.

* **Electronic Scanning Microscope for a Spectrographic Plate Comparator.** A scanning microdensitometer has been constructed for the purpose of analyzing spectrographic plates. The instrument facilitates reading the data and increases the speed and accuracy over other methods. A small section of the plate is scanned at one time and converted to a magnified X-Y plot of density versus wavelength displayed on the screen of a cathode ray oscilloscope. Resolution to better than 0.001 millimeter on the plate is consistently obtained, and the fiducial line remains stable to this precision for several hours. Provision is made for observing up to five adjacent spectrograms on a single plate. ***M. L. Kuder.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation*, v. 65C, no. 1, Jan.-Mar. 1961, p. 1-7.

Ultrasonic Doppler for Distance Measurement. High-efficiency transducers are utilized in a Janus Doppler system for distance measurement. Equations for the Janus system are developed for sound waves in a moving medium. A lightweight sonic doppler system is described which is comparable in size and weight to a modern auto radio. An experimental Janus system is discussed. Spectrum photographs for various road surfaces are presented. ***Melvin Wachspress.*** *IRE Transactions on Ultrasonics Engineering*, v. UE-8, no. 1, Mar. 1961, p. 6-13. (TK1 In6.6u Vis.)

Application of Ultrasonic Light Modulation to Signal Recording, Display, Analysis and Communication. Discusses background, principle of operation of ultrasonic light modulators, color modulation, frequency analysis with the ultrasonic light modulator, correlation techniques, and an infrared line-of-sight communication system. ***A. H. Rosenthal.*** *IRE Transactions on Ultrasonics Engineering*, v. UE-8, no. 1, Mar. 1961, p. 1-5. (TK1 In6.6u Vis.)

* **Viscoelastometer for Measurement of Flow and Elastic Recovery.** An account is given of the design, performance, and method of operation of a concentric cylinder rotational viscoelastometer. The instrument is designed for measurement of flow and time-dependent elastic recovery of viscous elastic liquids for temperatures at which the viscosity lies in the range of 10^6 to 10^{12} poises, and the elastic recovery is to be studied over a range of time from one second to one day. ***Richard J. Overberg and Herbert Leaderman.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation*, v. 65C, no. 1, Jan.-Mar. 1961, p. 9-21.

* **Investigation of the Bounce of a Periodically Switching Spring Contact Using a Vibrating Optical Shutter.** Using the example of a measuring contact, it is shown how the excitation of natural oscillations, and the resulting bounce of the contact, can be avoided by a design of the contact spring which comprises damping. The effect of bounce on the indicating accuracy of measuring contacts in phase angle measurements is assessed by calculation. (*In German.*) Untersuchung des Prellens eines

periodisch schaltenden Federkontaktes mit Hilfe eines optischen Schwingblendenverfahrens. ***Günter Ciessow and Floris Koppelmann.*** *ETZ: Elektrotechnische Zeitschrift*, v. 82, Ausgabe A, no. 4, Feb. 13, 1961, p. 111-114.

* **A Calibration Arrangement for Impulse-Voltage Measuring Apparatus, and Its Application.** An impulse voltage compensator is used as a calibrating device, and in this a direct voltage is compared with the peak value of the impulse voltage via a diode, and the impulse voltage which exceeds the direct voltage is used for indication. The accuracy of the calibrating arrangement depends mainly on the apparatus used for measuring the direct voltage and the charging voltage for the impulse generator. In the device constructed the total error for the calibrating apparatus was found to be 0.4% of the actual value, including the instrument error. (*In German.*) Eine Eicheinrichtung für Stossspannungsmessgeräte und ihre Anwendung. ***Eberhard Fischer.*** *ETZ: Elektrotechnische Zeitschrift*, v. 82, Ausgabe A, no. 4, Feb. 13, 1961, p. 97-102.

Some Uses of Radioisotopes in Continuous Measurement. Describes methods of producing low-energy electromagnetic radiation by means of radioisotopes and the use of such radiation in thickness measurement, analysis by preferential absorption and X-ray fluorescence-spectrometry. ***J. R. Rhodes.*** *Research Applied in Industry*, v. 14, Apr. 1961, p. 147-153.

Hot-Cathode Magnetron Ionization Gauge for the Measurement of Ultrahigh Vacua. ***J. M. Lafferty.*** *Journal of Applied Physics*, v. 32, Mar. 1961, p. 424-434.

A Precision Conductance Bridge of New Design. A bridge in which the essential component is a precision impedance comparator and which combines speed, wide range, and high accuracy in measurements. ***George J. Janz and James D. E. McIntyre.*** *Electrochemical Society, Journal*, v. 108, Mar. 1961, p. 272-276.

Precision Measurement and Calibration. Handbook 77. v. I. Electricity and Electronics. v. II. Heat and Mechanics. v. III. Optics, Metrology, and Radiation. A compilation of publications by the Bureau staff, that have been found of value to those who are establishing and operating new standards laboratories. This compilation is designed to serve as a reference source for the many scientists and engineers who must be trained in the shortest possible time to fill responsible positions in this critical area. ***Sherman F. Booth, compiler.*** v. I 840 pp.; v. II. 965 pp; v. III. 1036 pp. Feb. 1, 1961. U. S. Department of Commerce, National Bureau of Standards. (QC100 Un3.5p Over.)

LUBRICATION AND FRICTION

* **Quality Control Tests for Use in Grease Plants. Tentative Oil Release Test.** ***T. R. Welch.*** *NLGI Spokesman*, v. 25, no. 1, Apr. 1961, p. 5-11.

* **Phthalocyanines as High-Temperature Lubricants.** Demonstrates that metal-free phthalocyanine is a potential lubricant for extreme conditions of load and temperature. For the conditions under which the experiments were performed, metal-free phthalocyanine is most efficient as a lubricant in the temperature range of 800 to 1350 F. ***H. H. Krause, S. L. Cosgrove, and C. M. Allen.*** *Journal of Chemical and Engineering Data*, v. 6, no. 1, Jan. 1961, p. 112-118.

* **Critical Comparison of Several Fluids as High Temperature Lubricants.** Surveys hydrocarbon, organic acid ester, silicate, and silicone fluids and lubricants. Thus far, 700 to 800 F appears to be a practical upper limit for these liquid fluids in applications involving appreciable operating time at this temperature. ***E. Erwin Klaus, Elmer J. Tewksbury, and Merrell R. Fenske.*** *Journal of Chemical and Engineering Data*, v. 6, no. 1, Jan. 1961, p. 99-106.

Lubrication of Two Cylindrical Surfaces, Considering Cavitation. Treats hydrodynamic lubrication of two rotating rigid cylinders. These are lightly loaded and the lubricant viscosity is constant. ***Leif Floberg.*** *Chalmers Tekniska Högskolas Handlingar*, no. 234, 1961, 36 pp. (T4 C35t Vis.)

Attitude-Eccentricity Curves and Stability Conditions of the Infinite Journal Bearing. Analyzes the stability condition in oil flow continuity. ***Leif Floberg.*** *Chalmers Tekniska Högskolas Handlingar,* no. 235, 1961, 42 pp. (T4 C35t Vis.)

* **Non-Soap Greases. IV. Present Status of the Science With Special Consideration to High Temperature Applications.** ***J. J. Chessick.*** *NLGI Spokesman,* v. 25, no. 2, May 1961, p. 35-39.

Solid Lubricants. Describes the basic principle of thin-film lubrication and shows how, for example, solid copper may be used as a lubricant for steel. The dependence of boundary and extreme pressure lubrication upon the formation of solid films is discussed. The properties of the well-known solid lubricants, P.T.F.E., graphite, and MoS_2 are described and compared with those of less common solids TiI_2 and BN. Lubrication with polymers and with melting solids such as glass and ice is discussed. A few practical examples are chosen to illustrate the extremely wide range of conditions under which solid lubricants may be used successfully; from −200 to +2000 C, in any atmosphere or none at all. ***G. W. Rowe.*** *Research Applied in Industry,* v. 14, Apr. 1961, p. 137-142.

* **Ultrasonic and Visco-Elastic Relaxation in a Lubricating Oil.** Structural relaxation appears to play an equally important part in determining the second viscosity of the hydrocarbon oil as it does in associated liquids. ***N. S. Taşköprülü, A. J. Barlow, and J. Lamb.*** *Acoustical Society of America, Journal,* v. 33, Mar. 1961, p. 278-285.

MECHANICAL ENGINEERING

Pressure Vessels for Space, Aerospace, and Hydrospace. A Symposium. I. Evaluating Fracture Toughness. II. Materials for Space Pressure Vessels. III. Structural Significance of Ductility. IV. Titanium Alloys for Hydrospace Vehicles. *Journal of Metals,* v. 13, Mar. 1961, p. 195-205.

Impulsive Loading of Cylindrical Shells. The equations of motion of a thin cylindrical shell are solved for a general impulse load and for a specific loading case. Equations are given for computing membrane and bending stresses. ***W. B. Murfin.*** *U. S. Atomic Energy Commission, SCTM* 433-60(71), Feb. 1961, 32 pp. (UF767 Un3.1sct Contin.)

Seals Among NSU Developments on Rotating Combustion Engines. Reports progress on seals for the Wankel engine, as well as on spark plugs, cooling, fuel consumption and over-all durability. ***Walter G. Froede.*** *SAE Journal,* v. 69, Apr. 1961, p. 50-56.

The Dual Path Turbine Drive. New Buick Special automatic transmission. ***Charles S. Chapman and Rudolph J. Gorsky.*** *SAE Journal,* v. 69, Apr. 1961, p. 80-84.

Theory of Thermal Stresses. Basic theory; heat conduction principles; thermal stress analysis of elastic and inelastic systems. ***Bruno A. Boley and Jerome H. Weiner.*** 586 pp. 1960. John Wiley & Sons, New York. (TA405.5 B63t)

* **Stresses in a Pipe With a Discontinuous Bend.** Analysis is developed for stress systems in two long-straight-circular cylindrical pipes which are rigidly joined together over a plane section of each pipe to form one pipe with a discontinuous bend. The analysis is restricted to pipes with a small angle between normal sections of either straight part and the plane of join. In particular, stresses are evaluated at the bend when the pipe is closed at its ends and is under uniform normal internal pressure, or when the pipe is acted on by a pure symmetrical couple. ***A. E. Green and W. C. Emmerson.*** *Journal of the Mechanics and Physics of Solids,* v. 9, no. 2, Apr. 1961, p. 91-104.

* **The Buckling of a Dislocated Plate.** The buckling criteria for a thin circular dislocated plate is calculated for three types of dislocation. These are a sector inserted into the plate, a sector removed from the plate, the edge dislocation of solid-state physics at the center of the plate. It is concluded that it is mostly unlikely that edge dislocations observed in thin metal films by electron microscopy can relieve their long-range stress field by buckling the film. ***L. H. Mitchell and A. K. Head.*** *Journal of the Mechanics and Physics of Solids,* v. 9, no. 2, Apr. 1961, p. 131-139.

A New Look at Elastic-Body Mechanics. Explores the possibilities for use of elastic properties as the key to solution of design problems. ***C. W. Musser.*** *Machine Design,* v. 33, Apr. 13, 1961, p. 150-156.

METALLURGY

Titanium Founders Day. This article outlines the proceedings of this meeting and discusses the four problems which are met with new materials: how to introduce a new material; how to deal with critical problems; how to forecast requirements; and how to provide support. ***R. I. Jaffee.*** *Journal of Metals,* v. 13, Jan. 1961, p. 55-56.

Copper and Its Alloys. Free cutting coppers and stronger bolting materials are available. ***L. E. Gibbs.*** *Industrial and Engineering Chemistry,* v. 53, Apr. 1961, p. 337-338.

Copper Data. Properties, treatment and working, commercial grades, and applications. 18th Rev. Ed. 78 pp. 1960. Copper Development Association, London. (TN780 C79)

Aluminium Bronze. Properties, cold and hot working, casting, fabrications, and applications. Includes data on bronzes for high-temperature applications. 9th Rev. Ed. 172 pp. 1960. Copper Development Association, London. (TS650 C79a)

* **New Development in Casehardening Steels.** Two types of Cr-Mo steels recently developed are widely used in the automobile industry. For cog-wheels in the truck industry, steels have been developed with higher strength in the core (over 120 kg mm^2). These Cr-Mo steels, before casting, are treated with B, which increases the hardness of the core and thus the tensile strength. (*In German.*) Neuentwicklung von Einsatzstählen. ***H. Eitzert.*** *Metalen,* v. 16, no. 6, Mar. 31, 1961, p. 92-97.

* **New Processes in Producing Ferroalloys.** The importance of decarburized and nitrided ferroalloys for the production of alloyed steel is explained and a method to decarburize and nitride Fe-Cr and metallic Cr or Fe-Mn and metallic Mn is described. (*In Polish.*) Nowe procesy w produkcji żelazostopów. ***Hanna Żak, Zdzisław Kuliński, and Bolesław Paczuła.*** *Wiadomosci Hutnicze,* v. 17, Feb. 1961, p. 38-42.

METALS—CORROSION

Corrosion in Cryogenic Liquids. Cryogenic propellants can be handled by stainless steels. For missile service, Ti has more desirable strength-weight properties. However, Ti occasionally has shown impact sensitivity to liquid oxygen and fluorine. This paper discusses corrosion mechanisms and the physical behavior of Ti and other metals in cryogenic propellants. ***James D. Jackson.*** *Chemical Engineering Progress,* v. 57, Apr. 1961, p. 61-64.

Atmospheric Corrosion-Fatigue of Age-Hardened Aluminium Alloys. Specimens of aluminium-4% copper alloy, a Duralumin-type alloy to B.S. L65, and D.T.D. 683 alloy have been fatigued in air, in vacuum, and in various gaseous environments. Of all the constituents of normal air, only water vapor significantly affected fatigue life. Improvements in life of about eight times, compared with lives in air of 10^5 cycles, could be achieved in well-dried environments. A variety of surface treatments were applied to similar specimens fatigued in air, but comparable improvements were obtained only with a butyl rubber coating selected for its impermeability to water vapor. Accelerated fatigue in the presence of water vapor appears to be concerned with both crack initiation and crack growth; it is suggested that the mechanism involves the production of hydrogen ions at clean surfaces exposed by slip, and the diffusion of the ions into the metal. ***Trevor Broom and Anthony Nicholson.*** *Institute of Metals, Journal,* v. 89, pt. 6, Feb. 1961, p. 183-190.

Oxidation of Metals. A well-annotated review of the theory of metal oxidation and corrosion. ***W. W. Smeltzer and J. M. Perrow.*** *Industrial and Engineering Chemistry*, v. 53, Apr. 1961, p. 319-324.

Oxidation of Copper Between 250 and 450 C and the Growth of CuO "Whiskers". A study was made of the oxidation of Cu, using the vacuum microbalance method to determine the kinetics of reaction, X-ray and electron diffraction methods for study of the oxide crystal structures, and a high resolution electron microscope to determine the size and surface density of the oxide whiskers. On the basis of the cubic-rate-law plots and analyses of the whiskers' size and density, it is concluded that the formation of oxide whiskers, although of great interest as a natural phenomena, had no appreciable effect on the kinetics of the oxidation process. ***E. A. Gulbransen, T. P. Copan, and K. F. Andrew.*** *Electrochemical Society, Journal*, v. 108, Feb. 1961, p. 119-123.

Kinetics and Mechanism of Hydrogen Attack of Steel. A model is presented in which incubation is controlled by the reduction of grain-boundary iron oxides forming water vapor which acts to inhibit the accumulation of methane in the boundaries by reacting with it; grain-boundary methane pressure forming a network of fissures and/or stress concentrators acts as the embrittling agent; when the carbides are stabilized by spheroidization or alloying, resistance to attack is increased since carbide dissolution controls both incubation and embrittlement. ***L. C. Weiner.*** *Corrosion*, v. 17, Mar. 1961, p. 109-115.

* **Anodic Protection.** Anodic protection appears to be a promising method of controlling corrosion, especially in acid solutions. The effectiveness of the process for any given case can be assessed by relatively simple laboratory experiments and calculations. The limitations of the process decrease considerably if absolute safety is not demanded and it is suggested that this may not always be necessary, especially if a monitoring system is used in conjunction with protection. ***C. Edeleanu and J. G. Gibson.*** *Chemistry & Industry*, 1961, no. 10, Mar. 11, p. 301-308.

* **Corrosion Instruments and Instrumentation Review.** Covers some of the developments that have taken place with instruments and instrumentation which contribute directly or indirectly to the limitation or elimination of corrosion. *Corrosion Technology*, v. 8, Mar. 1961, p. 83-87.

* **Potentiostats for Corrosion Studies.** Recent developments in the design of potentiostats have resulted in an improved approach to electrochemical study of corrosion in the laboratory. Summarizes the performance of suitable instruments either commercially available or in circuit form and describes some of their practical applications. ***I. Dugdale.*** *Corrosion Technology*, v. 8, Mar. 1961, p. 77-78.

Anodic Behavior of Austenitic Stainless Steels and Susceptibility to Stress Corrosion Cracking. The anodic behavior of a purified 16 Cr-20 Ni stainless steel, which was unsusceptible to stress-corrosion cracking, was compared with that of a susceptible 18 Cr-8 Ni alloy in 42% $MgCl_2$ at 146 C. Potential-time curves, potential-current curves, and potentiostatic current-time curves were compared. The potential-time behavior of pure Fe, Cr, and Ni was also determined and indicated that dissolution from a Ni-rich surface controlled the anodic behavior of the stainless steels. From potential-current curves it was shown that propagation is accompanied by enhanced metal dissolution, in agreement with the general electrochemical mechanism of cracking. ***S. Barnartt and D. van Rooyen.*** *Electrochemical Society, Journal*, v. 108, Mar. 1961, p. 222-229.

Localization of Ferrous Corrosion by Azide. Interactions between ferrous materials and aqueous sodium azide solutions at ambient temperature are described. The azide is both a corrosion inhibitor and a reagent indicating localized areas of attack. It may serve to differentiate alloy steels and perhaps to show corrodible areas in welds. ***P. Hersch.*** *Nature*, v. 190, Apr. 8, 1961, p. 163-164.

* **Influence of Water Movement on Corrosion. Non-Ferrous Metals.** The effects of water movement on the corrosion on nonferrous metals is reviewed in the light of the recent literature and of experimental work in progress at the Admiralty Materials Laboratory. ***N. V. Nowlan.*** *Corrosion Technology*, v. 7, Dec. 1960, p. 397-399.

Oxidation of High-Purity Aluminum and 5052 Aluminum-Magnesium Alloy at Elevated Temperatures. Oxidation of chemically polished high-purity aluminum in dry oxygen, water vapor, and moist air at temperatures from 450 to 640 C is characterized by a near-linear reaction rate to a weight gain of 3 $\mu g/cm^2$, followed by a rate that decreases rapidly with further weight gain. Oxidation is slightly faster in the moist atmospheres than in dry oxygen at temperatures above 550 C. ***C. N. Cochran and W. C. Sleppy.*** *Electrochemical Society, Journal*, v. 108, Apr. 1961, p. 322-327.

Critical pH and Critical Current Density for Passivity in Metals. Based on electrochemical mechanisms, an equation is derived for the relation of *p*H to the critical current density necessary to passivate metals. A critical *p*H exists above which passivity is stable, but not below. This critical *p*H decreases linearly with the logarithm of dissolved O_2 concentration. Among the metals achieving high corrosion resistance in deaerated acids are Ti, Ta, Zr, and Mo. ***Herbert H. Uhlig.*** *Electrochemical Society, Journal*, v. 108, Apr. 1961, p. 327-330.

Corrosion of Prestressed Wire in Concrete. After a brief review of the various types of corrosion, the few corrosion failures which have occurred in prestressed wire in concrete are discussed. A summary of the laboratory investigations of corrosion of prestressed wire in concrete that have been reported in the literature is followed by an account of the studies carried out in the laboratories of the Portland Cement Association. These latter studies included tests of the effects on corrosion of such factors as type of cement, type of wire, wire stress, addition of calcium chloride, curing conditions, storage conditions, and voids in the concrete adjacent to the wires. Because of this hazard, it is recommended that calcium chloride not be used in prestressed concrete. ***G. E. Monfore and G. J. Verbeck.*** *Portland Cement Association, Research Department Bulletin* 120, Dec. 1960, 25 pp. (TP883 P83b Vis.)

METALS—EXTRACTION AND REFINING

Vacuum Melting Produces Cleaner, Better Performing High-Temperature Brazing Alloys. These alloys are suitable for use with 0.001-0.005-in. core materials in honeycomb brazing as well as bridging up to 0.060-in. joint clearances. ***C. R. Benson.*** *Welding Journal*, v. 40, Mar. 1961, p. 232-236.

* **Back Pressure and Various Injections. Experience With the International Low Furnace at Liège.** After a brief description of the drawbacks of this type of furnace, the author proposes three remedies: preparation of the burden, use of high back pressure in the throat, and injection of hydrogenated products in the tuyeres. Several test runs were carried out: injection of light fuel and blast superheating, fuel injection and increased O content, injection of residual gas and blast superheating, and injection of coking gas. (*In French.*) Contrepression et injections diverses expérience acquise au bas fourneau international de liège. ***E. Bonnaure.*** *Revue de Métallurgie*, v. 58, Jan. 1961, p. 13-24.

* **Observations on the Wear of Refractory Linings of Stacks in Sinter-Consuming Blast Furnaces.** Study of the operation of four blast furnaces of the "Société Métallurgique" at Knutange, two furnaces of the Chiers works, three Völklingen and two Seraing furnaces, where troublesome operation was observed when sinter was used. The authors believe that the refractory used is not alone responsible, but that in particular the blasting conditions are involved; further, the part played by the cooling equipment is discussed. The problem is far from being solved. (*In French.*) Remarques sur l'usure des revêtements réfractaires de cuves de hauts fourneaux consommant des agglomérés. ***Ch. Pastor and J. Laborne.*** *Revue de Métallurgie*, v. 58, Jan. 1961, p. 25-38.

* **Results Obtained With the Use of Automatic Measuring and Regulation Equipment in Open-Hearth Furnaces.** Status of development of automatic equipment for open-hearth furnaces in the German Democratic Republic. (*In German.*) Ergebnisse

der Anwendung automatischer Mess - und Regelanlagen an Siemens-Martin-Öfen. ***Friedhold Rabes.*** *Neue Hütte,* v. 6, Feb. 1961, p. 65-71.

Zone Refining and Allied Techniques. Gives practical information on recent advances in laboratory methods and equipment. Attempts to meet all needs, by the presentation of equipment ranging from inexpensive, easily constructed apparatus to carefully designed and specially constructed complex installations for high-precision production. ***N. L. Parr.*** 184 pp. 1960. George Newnes Ltd., London. (TN687 P24z)

* **New French Method to Produce Aluminum.** Carbon thermal reduction is applied in two stages: fabrication in electric furnace of pure corundum by selective reduction of bauxite in electric furnace; reduction of the corundum obtained or of Bayer Al in electric furnace in the presence of C. In the first stage impurities are eliminated. In the second stage Al oxide is reduced. A spongy Al-Al carbide mixture results. At suitable temperature and in the presence of appropriate fluxes Al exudes from the carbide mass which is recycled. The yield capacity of the pilot plant under construction will be of 4,000 to 5,000 tons per year. (*In French.*) Nouveau procécé français de production de l'aluminium. *Revue de l'Aluminium,* v. 38, no. 283, Jan. 1961, p. 58-59.

* **Fluid Mold Casting Cuts Ingot-to-Billet Costs.** Such materials as high-temperature alloys, and ingots of stainless and tool steels weighing more than 50,000 lb., are produced for forgings by this method. ***J. T. Evans.*** *Western Metalworking,* v. 19, Apr. 1961, p. 27-28.

* **Giant Electron Beam Furnace Casts 20-in. Ingots.** *Western Metalworking,* v. 19, Apr. 1961, p. 38-39.

Taconite Pellets in the Blast Furnace. Presents operating data and results of a ten-year test program, as well as results obtained in recent years with commercial taconite pellets. ***W. E. Marshall.*** *Journal of Metals,* v. 13, Apr. 1961, p. 308-313.

* **Vacuum Degassing in Service of Metallurgical Copper Alloys.** Vacuum degassing of Cu alloys was conducted on equipment provided with two rotary oil air pumps (1000 m³/hr). The molten Cu-Sn 12 and Cu-Sn 10-Pb 5 alloys were degassed in a graphite crucible placed under 4.5 to 11 mm Hg during 2 to 10 minutes. The vacuum process improves the mechanical properties, the tensile strength and the elongation depending on the pressure obtained and the degassing time. Increased P contents worsen the mechanical properties of Cu-Sn 10-Pb 5 and can suppress the favorable effect of the vacuum process. (*In Czech.*) Provozní vakuové odplynění slévárenských slitin mědi. ***Zdeněk Motloch and Jiři Saip.*** *Hutnik (Czech),* v. 11, no. 3, Mar. 1961, p. 128-131.

* **The Possibilities of the Basic Side-Blown Converter.** Compared with LD and Kaldo vessels, the modified side-blown converter described appears to combine all the merits of both with a higher degree of flexibility. ***G. Reginald Bashforth.*** *British Steelmaker,* v. 27, Apr. 1961, p. 115-119.

METALS—FINISHING, POLISHING AND CLEANING

Finishing Supplement: Cleaning of Surfaces. Considers metal treatments. ***E. E. Bishop.*** *Metal Industry,* v. 98, Feb. 17, 1961, p. 127 + 4 pages.

How to Polish Long Extrusions—Automatically. Discusses two automated buffing machines used to polish Al extrusions. *Precision Metal Molding,* v. 19, Mar. 1961, p. 63-64.

* **Preparation of Some Metals for Painting.** A survey is given of the wide variety of methods available for the pretreatment of metals, and of iron and steel, Al and Zn in particular. The metal must first be degreased; secondly, the corrosion products must be removed either by mechanical methods, e.g., shot blasting, or chemically, e.g., by acid or alkaline treatment. Thirdly, the metal must be chemically treated to improve the corrosion resistance. For iron and steel this is generally effected by phosphating; metal spraying and electroplating are also

mentioned. For Al, anodizing and chromate conversion coatings are employed for corrosion resistance; similar processes are also used for Mg. ***J. Glossop.*** *Oil & Colour Chemists' Association, Journal,* v. 44, Apr. 1961, p. 269-278.

Cleaning in the Electronics Industry. Current trends in the electronics industry which have created a need for more effective control over both the type and amount of residual contaminants. Contaminants are classified and examples are presented of their effects on the performance of typical devices. ***D. E. Koontz, D. O. Feder, and C. O. Thomas.*** Paper from "Technical Proceedings of the Forty-Seventh Annual Convention, American Electroplaters' Society, July 24-28, 1960", p. 188-189, 1960. American Electroplaters' Society, Inc., Newark, N. J. (TS670 AM35p Vis.)

METALS—FOUNDRY PRACTICE

* **What to Expect From Vacuum Diecasting.** Reviews the field of pressure diecasting with elevated molds, discusses problems, and suggests remedies. Vacuum diecasting machines of the past and present are also discussed. ***F. C. Bennett.*** *British Foundryman,* v. 54, Feb. 1961, p. 54-58.

* **Practical Observations on Mould Stability as a Factor in Controlling the Soundness of Grey-Iron Castings.** ***A. D. Morgan and J. M. Greenhill.*** *British Foundryman,* v. 54, Feb. 1961, p. 45-53.

* **An Evaluation of Feeding Heads and Feeding Aids for Castings.** *British Foundryman,* v. 54, Feb. 1961, p. 66-90.

Design Guides for Pressure-Tight Gray-Iron Castings. A design guide to factors which make gray iron suitable for pressure-tight applications: Nonporosity, soundness, strength, machinability, rigidity. ***Charles F. Walton.*** *Machine Design,* v. 33, Mar. 16, 1961, p. 162-164.

Most Magnesium Alloys Can Be Investment Cast. This research work showed that there are many alloys which can be investment cast so that the designers choice is no longer limited to AZ92A. ***Kenneth Herrick and Harry Matthieson.*** *Precision Metal Molding,* v. 19, Mar. 1961, p. 53-55.

Examining the Causes of Shrinkage Defects in Grey Iron Castings. Provides the foundryman with a series of practical examples showing how he may evaluate the effects of the factors in the foundry and decide on their responsibility for unsoundness problems. ***A. G. Fuller and K. E. L. Nicholas.*** *B.C.I.R.A. Journal,* v. 9, no. 2, Mar. 1961, p. 173-184.

Graphite Injection Through the Tuyeres of a Cold Blast Cupola. A process for injecting powdered graphite through one of the tuyeres of the cupola, using compressed air as the carrier gas. Equipment required and the procedure are given and the effects on casting properties, notably chill and shrinkage, are considered. ***H. J. Leyshon, R. B. Coates, and K. E. L. Nicholas.*** *B.C.I.R.A. Journal,* v. 9, no. 2, Mar. 1961, p. 189-198.

* **Permanent Mold Cast Titanium Slashes Die Costs, Hikes Output.** Process is called "Impel Casting". *Western Metalworking,* v. 19, Apr. 1961, p. 31.

* **Aerospace Industries...Stepping Stone to New Castings Markets.** Today's market demands mobile equipment that is lighter for a given strength level than its predecessor, requires less power to move, and makes more power available for doing work. The design requirements specified by the aerospace industry should be accepted by the foundry industry as a stepping stone toward improved products. The foundry of the future is going to be one that is based on sound basic technology and good quality control, as well as sound management. ***John Varga, Jr.*** *Modern Castings,* v. 39, Apr. 1961, p. 38-39.

* **Boeing Uses Advanced Techniques in Sand Casting Turbine Engine Parts.** Use of Olivine molding sand and CO_2 coring process typify a progressive approach to aluminum sand castings. ***K. B. Rhodie.*** *Modern Metals,* v. 17, no. 3, Apr. 1961, p. 40 + 1 page.

METALS—HEAT TREATMENT

*** Controlled Atmospheres for Heat Treatment.** Atmospheres may be derived from town gas, liquid petroleum gases, alcohols and hydrocarbons, ammonia or steam. For special purposes the rare inert gases, argon and helium, are also employed. ***L. G. W. Palethorpe.*** *Overseas Engineer*, v. 34, Mar. 1961, p. 238-240.

Heat Treatment of Cast Stainless Steels. Part III of series of three. Discusses semi-austenitic stainless AM-355. ***W. P. James.*** *Precision Metal Molding*, v. 19, Mar. 1961, p. 56-57.

*** Economical Uses of Alloys in Steel Manufacturing.** Organizational and metallurgical measures—Saving of alloys by heat treatment. (*In German.*) Ökonomischer Legierungseinsatz bei der Stahlherstellung. ***Wolfgang Küntscher.*** *Neue Hütte*, v. 6, Feb. 1961, p. 72-77.

*** High-Temperature Heating of Steels for Heat Treatments.** In a Moscow car factory steels are heated well above Ac_3 prior to forging while keeping their good mechanical properties, but the temperature at which sulfur begins to accumulate at the grain boundaries must not be exceeded. For case hardening and carbonitriding, gear steels are heated by induction at 1,100 C without reduction in strength. (*In French.*) Le chauffage a haute température des aciers pour traitements thermiques. ***M. Assonov.*** *Revue de Métallurgie*, v. 58, Mar. 1961, p. 267-270.

Induction Heating. Describes basic theory and applications in hardening, heat treating, forming, joining, reflowing of electrolytically coated tin, melting, and semiconductor production. ***John M. Edwards.*** *Westinghouse Engineer*, v. 21, no. 3, May 1961, p. 84-89.

*** Processes Occurring During the Tempering of Nickel Steels.** In a group of steels with 1% C and a varying Ni concentration from 0.5 to 10%, the processes taking place during tempering between 100 and 650 C were studied. There is formation of low-temperature and high-temperature phases (ϵ- and χ-carbides), a change in the amount of carbide phases with the increase in the tempering temperature, and an effect of Ni on the strength of these phases. The chemical composition of the χ-carbide was determined. (*In Russian.*) Protsessy, protekaiushchie pri otpuske nikelevykh staleĭ. ***B. M. Iakovlev and B. A. Apaev.*** *Fizika Metallov i Metallovedenie*, v. 11, no. 2, Feb. 1961, p. 261-271.

*** Studying on the Exchange of Matter Being Possible Between Furnace Atmosphere and Product Annealed When Annealing Cold Worked Steels in a Protective Gas Atmosphere.** Possibilities of reaction when annealing steel in a protective gas atmosphere. Deviations from the water gas equilibrium. Protective gases adapted for annealing low-carbon steel. (*In German.*) Über den möglichen Stoffaustausch zwischen Ofenatmosphäre und Glühgut beim betrieblichen Glühen von kalt verformten Stählen im Schutzgas. ***Theodor Schmidt and Joachim Wünning.*** *Stahl und Eisen*, v. 81, no. 6, Mar. 16, 1961, p. 361-366.

*** Heat Treatment of Titanium-Iron-Manganese Alloys.** Generally, on water-quenching from temperature of β-phase, quantity of martensite transformation from β to α' decreases with increasing β-stabilizing alloying element until at a critical % value required to reduce the Ms temperature, and if the concentration of addition element is above the critical value, retained β-phase can be produced by quenching. ***Yōtarō Murakami and Toshio Enjyō.*** *Kyoto University, Engineering Research Institute, Technical Reports*, no. 76, Dec. 1960, 17 pp.

METALS—MECHANICAL AND PHYSICAL PROPERTIES

The Elevated-Temperature Properties of Aluminum and Magnesium Alloys. Contains data on more than 50 alloys. ***Howard R. Voorhees and James W. Freeman, compilers.*** 308 pp. Oct. 1960. American Society for Testing Materials, Philadelphia, Pennsylvania. (TA480.A6 V89r)

a **A Comparison of Niobium-Vanadium and Niobium-Zirconium Alloys for Structural Applications in Boiling Water Reactors.** Tensile, creep, hot hardness, fabrication, and corrosion data were obtained. ***D. L. Douglass.*** *Nuclear Science and Engineering*, v. 9, Mar. 1961, p. 391-398.

• **The Effect of Decreases in Stress on the Creep Behavior of Polycrystalline Aluminum in the Dislocation Climb Region.** ***L. Raymond, W. Ludemann, N. Jaffe, and J. E. Dorn.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 60-326, May 1960, 11 pp. (TL507 Un3.18w Vis.)

b **Influence of Hot-Rolling Conditions on Brittle Fracture in Steel Plate.** Conventional and controlled (low finishing temperature) rolling practices were studied to establish reasons for a superior notch toughness in the controlled rolled product. ***F. de Kazinczy and W. A. Backofen.*** *U. S. Ship Structure Committee, SSC*-126, Nov. 10, 1960, 26 pp. (VM1 Un3.7s Contin.)

• **Structural Analysis of Molybdenum-Base Alloys by Use of a Material Constant and the Least-Square Error.** Data from an investigation by the Climax Molybdenum Company and the Battelle Memorial Institute are re-evaluated and presented in a form useful to structural designers and analysts. ***A. L. Ross and B. R. Thompson.*** *U. S. Atomic Energy Commission, APEX*-568, Feb. 28, 1957, 24 pp. (UF767 Un3.1ap Contin.)

c **Effect of Impurities on Mechanical Properties of Electrolytic Titanium.** Effect of O, N, C, and Fe (at low levels). The strength and hardness of binary TiO, Ti-N, and Ti-C alloys are linear functions of alloy content in the composition range investigated. Compared to O and C, N is the most effective strengthener and hardener, followed by O, then C. When the C concentration is above 0.10%, carbides are present, and strength and hardness are relatively unchanged. For equivalent hardness levels, Ti-Fe alloys are stronger than binary Ti alloys containing O, N, or C. However, the strengthening is related to the presence of transformed beta in the structure. ***J. D. Ramsdell and D. R. Mathews.*** *U. S. Bureau of Mines Report of Investigations* 5701, 1960, 12 pp. (TN21 Un3r Room 290)

• **Effect of Alloying Elements on, and Calculation of, the Tensile and Yield Strengths of Low-Alloy Steels.** ***M. S. Mikhalev and M. I. Gol'dshtein.*** *Henry Brutcher Translation No.* 4886, 12 pp. (From *Stal'*, v. 18, no. 10, 1958, p. 942-946. Henry Brutcher, Altadena, Calif.

d **Effect of Deoxidation of Alloy Constructional Steels With Aluminum on Their Susceptibility to Irreversible Temper Brittleness.** Data answering the question as to whether Al suppresses irreversible temper brittleness by preventing the precipitation of Cr and Mn nitrides, or simply by refinement of the austenite grain. ***E. N. Sokolov, G. V. Gaidukov, and V. D. Sadovskii.*** *Henry Brutcher Translation No.* 4946, 3 pp. (From *Fizika Metallov i Metallovedenie*, v. 1, no. 2, 1955, p. 366-367.) Henry Brutcher, Altadena, Calif.

• **A Low-Temperature Inflection in the Temperature-Dependence of Hardness of Pure Metals.** ***E. R. Petty.*** *Institute of Metals, Journal*, v. 89, pt. 4, Dec. 1960, p. 123-124.

e **The Properties of Some Metals and Alloys at Low Temperatures.** The results are reported of tests at temperatures down to −196 C on four classes of materials, viz: Cu and copper alloys (arsenical copper, brass, 90:10, 80:20, and 70:30 cupro-nickel, Kunifer 5 and 20, and Superston 40, a manganese-aluminium bronze); nickel alloys (Monel and Inconel); austenitic stainless steels (titanium-stabilized 18% chromium, 8% nickel steel, without and with 3% Mo); and low-carbon nickel steels (2¼, 3½, and 9% nickel). The tests consisted of plain and notched tensile tests, U. S. Navy tear tests, and Charpy V-notched impact tests, carried out on plate ½-¾ in. thick. ***R. E. Lismer.*** *Institute of Metals, Journal*, v. 89, pt. 5, Jan. 1961, p. 145-161.

f **Creep-Rupture.** Considers stress, temperature and time, sensitivity and scatter, the three types of high-temperature alloys, and effects of heat treatment and cold work. ***F. J. Claus.*** *Materials in Design Engineering*, v. 53, no. 1, Jan. 1961, p. 89-100.

The Hardness of Iron, Low-Carbon Steels, and Cast Iron Roll Materials at Various Temperatures. Blue hardening is investigated and interpreted as an increase in the strain-hardening capacity. Compared with spheroidal graphite iron. ***E. R. Petty and Hugh O'Neill.*** *Iron and Steel Institute, Journal,* v. 197, pt. 2, Feb. 1961, p. 141-146.

Hot Hardness Values in Relation to the Physical Properties of Metals. Diamond pyramid tests indicate a direct relationship between the thermal coefficient of softening and the coefficient of thermal expansion. Elastic modulus for cubic-type metals gives a linear relation with hardness. The log of various creep-stress values when plotted against hot-hardness values shows a direct relationship. The possibilities of hot-hardness testing are discussed, including its application to metals, showing allotropic changes. ***E. R. Petty and Hugh O'Neill.*** *Metallurgia,* v. 63, Jan. 1961, p. 25-30.

Energy Versus Stress Theories for Combined Stress—A Fatigue Experiment Using a Rotating Disk. An experiment is described in which the strain energy at the critical location for fatigue failure is maintained constant while the stresses on a given plane of the material at the same location are caused to fluctuate. The fact that fatigue cracks were developed in the region of constant strain energy was considered to indicate that a concept of a fluctuating strain energy as a basic theory of failure by fatigue under combined stresses is not tenable. ***W. N. Findley, P. N. Mathur, E. Szczepanski, and A. O. Temel.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 83, no. 1, Mar. 1961, p. 10-14.

Investigation of the Fatigue Properties of Molybdenum Under Various Conditions of Temperature, Coatings, and Stress Concentration. At room and low temperatures, the fatigue strength of unprotected specimens was relatively high. The notch sensitivity of unprotected Mo was low at 1800 F, but rather high at room and low temperatures. All coatings lowered the fatigue strength of Mo at all three temperatures. ***Alexander A. Mittenbergs, Dean N. Williams, Robert I. Jaffee, and Horace J. Grover.*** *U. S. Air Force, Wright Air Development Division, WADD Technical Report* 60-427, Oct. 1960, 130 pp. (TL507 Un3.18w Vis.)

The Brittle Fracture of Steel. A comprehensive review of the present knowledge on the brittle behavior of structural steels. Summarizes the service failures which led to the intensive investigations carried out in the past decade; discusses the factors which influence the response of metals to plastic flow in the light of current theories of the initiation and propagation of fracture. ***W. D. Biggs.*** 420 pp. 1960. Pitman Publishing Corp., New York. (TA473 B48b)

A Study of Theories of Fracture Under Combined Stresses. Experimental data are presented for a cast nodular iron and for high-silicon cast iron materials which represent limiting conditions of ductility in a test of fracture theories. Data of other pertinent investigations are reviewed and various failure theories are discussed with regard to their applicability. It is concluded that failure under combined stresses of brittle materials can be predicted adequately by applying a notch modified distortion energy criterion. ***I. Cornet and R. C. Grassi.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 83, no. 1, Mar. 1961, p. 39-44.

Microplastic Strain Hysteresis Energy as a Criterion for Fatigue Fracture. Microplastic strain hysteresis energy is considered to be an index for fatigue damage. On this basis, a relation is developed between stress amplitude and the number of cycles to failure which utilizes only material properties obtained from the static true stress-strain tension test. The analysis is found to compare well with an experimentally determined S-N curve for SAE 4340 steel. ***C. E. Feltner and Jo Dean Morrow.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 83, no. 1, Mar. 1961, p. 15-22.

Crack Propagation in Thin Metal Sheet Under Repeated Loading. Sheet specimens of 2024-T3 aluminum alloy containing a central hole were tested. Stress range and mean stress were the controlled parameters. An expression for crack length was derived, based on the concept of geometric similarity of crack configuration, for a semi-infinite sheet subjected to repeated loads consisting of a constant stress and mean stress. ***H. W. Liu.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 83, no. 1, Mar. 1961, p. 23-31.

Cryostat and Accessories for Tension Testing at —423 F. An apparatus using liquid H as a coolant was designed, constructed, and used to determine the mechanical properties of various materials at —423 F. Attributes of the equipment are: rapidity of testing; accommodation of large-size specimens; flexibility for testing different materials at several temperatures; and safety features. The accessories include a liquid-level indicator, thermocouples, heater, and an extensometer designed for low-temperature use. ***James F. Watson and Jack L. Christian.*** *Materials Research & Standards,* v. 1, Feb. 1961, p. 87-90.

Measurements Pertaining to Hydrogen Embrittlement. Measuring techniques which have been useful in hydrogen embrittlement studies are described, and their usefulness for future studies is critically examined. Included in the discussion are hydrogen charging methods, stressing methods, analytical problems, surface effects, and related phenomena. Problems in developing a standard embrittlement test are outlined. ***Cloyd A. Snavely.*** Paper from "Technical Proceedings of the Forty-Seventh Annual Convention, American Electroplaters' Society, July 24-28, 1960", p. 138-142, 1960. American Electroplaters' Society, Inc., Newark, N. J. (TS670 AM35p Vis.)

Mechanical Properties of Zircaloy-2. The mechanical and physical properties of Zircaloy-2 were determined as a function of five test variables: temperature, grain size, direction to rolling, hydrogen content, and the presence or absence of a notch. The investigation included studies of the coefficient of thermal expansion, elastic modulus, tensile properties, creep properties, and low-cycle fatigue properties. Approximately 470 specimens from a single ingot were tested in the course of the investigation. ***R. L. Mehan and F. W. Wiesinger.*** *U. S. Atomic Energy Commission, KAPL*-2110, Feb. 1, 1961, 47 pp. (UF767 Un3.1ka Contin.)

METALS—MECHANICAL WORKING

* **Cold Rolling Oils—Condition of Oils During Annealing of Steel and Their Chemical and Physical Properties.** Some seventy oils of different kinds were studied in respect of their chemical, physical and technological properties. (*In Swedish.*) Kallvalsningsoljor—Oljornas förhållande vid stålets glödgning och deras kemiskt-fysikaliska egenskaper. ***Torkel Berglund.*** *Jernkontorets Annaler,* v. 145, no. 1, 1961, p. 25-46.

* **The Embrittlement of Titanium Alloys Resulting From Machining.** In addition to mechanical strain hardening occurring when cutting, embrittlement of the surface layer, caused by the absorption of oxygen and nitrogen from the air under the high local temperatures present in the cutting area, can be observed when machining titanium alloys. As a result, the components' resistance to alternating stresses is reduced. Embrittlement can be avoided by working under vacuum or in a protective atmosphere. (*In German.*) Das Verspröden von Titanlegierungen infolge spanender Bearbeitung. ***Walter Gröbner.*** *VDI Zeitschrift,* v. 103, no. 11, Apr. 1961, p. 484.

* **Exploring Metalcutting Phenomena With Dimensional Analysis.** ***Max Kronenberg.*** *Tool and Manufacturing Engineer,* v. 46, no. 6, May 1961, p. 90-92.

* **Electromagnetic Metal Forming—High Energy Exerts Shaping Force.** Describes how the forces are built up and applied to a workpiece. ***A. P. Langlois.*** *Tool and Manufacturing Engineer,* v. 46, no. 6, May 1961, p. 105-108.

Fresh Approach in Machining Takes Aim on Hard Steels. Describes tools and procedures for cutting steels of 300 Bhn and above. ***R. H. Eshelman.*** *Iron Age,* v. 187, no. 17, Apr. 27, 1961, p. 101-108.

Explosive Forming. Reviews recent developments in equipment and procedures. *Light Metals,* v. 24, Apr. 1961, p. 115-116.

A Radiotracer Method for Studying Lubrication With Glass. A Novel Technique in High Temperature Lubrication Studies. Plant scale studies were made of glass lubricants containing Na-24 for hot extrusion of steel. ***G. W. Rowe and J. Golden.*** *Scientific Lubrication*, v. 13, Apr. 1961, p. 18 + 3 pages.

* **Effect of the Built-Up Edge on a Cutter on the Surface Quality of Aluminium Alloys.** ***V. B. Livshits.*** *Machines and Tooling* (Translation of Stanki i Instrument), v. 31, no. 11, Nov. 1960, p. 29-31.

* **Effects of Ultrasonic Vibrations in Machining Creep Resistant Alloys.** ***A. A. Voronin and A. I. Markov.*** *Machines and Tooling* (Translation of *Stanki i Instrument*), v. 31, no. 11, Nov. 1960, p. 15-18.

* **An Experimental Determination of the Detailed Distortion in Hot Rolling.** A technique was developed for measuring the distortion occurring in the arc of contact of a rolling mill, under conditions simulating hot rolling. A single configuration was considered, typical of the final stages of hot-rolling wide strip in industry, and comparison made of the conditions existing on interior and exterior sections of the metal in the arc of contact. It was not found possible to derive a slip-line field from the experimental results, due to the excessively wavy character of the velocity variation along the streamlines. This is possibly due to the influence of the grain structure of the material used, which was commercially pure aluminum and to an insufficiently precise rolling technique. ***B. F. Milsom and J. M. Alexander.*** *Journal of the Mechanics and Physics of Solids*, v. 9, no. 2, Apr. 1961, p. 105-113 + 1 plate.

* **Sculpturing Hard Metal.** Significant features of electrolytic shaping are: there is no physical contact between tool and workpiece, hence, there is no pressure on the workpiece; ultrathin metals can be electroshaped as easily as heavy sections; no burrs develop; the process is noiseless and there are no sparks, no chatter, no crunch, and no dust; and the process is simple to operate. ***Charles L. Faust.*** *Industrial Science and Engineering*, v. 8, no. 4, Feb. 1961, p. 27-30.

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

The Diffusion Coefficient for Oxygen in Alpha-Zirconium. The coefficient has been determined by microhardness measurements within the range 400-850 C. The results are expressible as $D = 69.2 \exp(-56{,}187/RT)$ above 700 C, and as $D = 9.13 \times 10^{-5} \exp(-29{,}815/RT)$ below 700 C. ***M. Davis, K. R. Montgomery, and J. Standring.*** *Institute of Metals, Journal*, v. 89, pt. 5, Jan. 1961, p. 172-174.

* **Some Problems of the Physical Metallurgy of Uranium.** The metallurgical factors influencing the use of U in the metallic form in nuclear reactors are its orthorhombic structure and the presence of impurities. The examination of the basic processes was made possible by the production of high-purity U. Carbon is the most important of the impurities. A phase diagram of U-C alloys is given and the thermal treatment of this alloy is described. (*In French.*) Quelques problèmes la métallurgie physique de l'uranium. ***B. Blumenthal.*** *Revue Universelle des Mines*, v. 17, ser. 9, Jan. 1961, p. 12-20.

Precision Lattice Parameter Determination of Zirconium-Oxygen Solid Solution. Measurements were made on back-reflection X-ray photograms obtained at 29 C, using a symmetrical focusing camera. ***Barry D. Lichter.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 218, no. 6, Dec. 1960, p. 1015-1018.

* **Formability of Magnesium Single and Polycrystals.** Investigates the characteristic of Mg of exhibiting formability only within a narrow temperature range. The correlation with crystal structure is demonstrated through a survey of literature data. The explanation of the phenomenon is given. (*In Hungarian.*) A magnézium egy- és többkristály alakíthatósága. ***Emőd Gyula.*** *Kohászati Lapok*, v. 94, no. 2, Feb. 1961, p. 49-56.

X-Ray Metallography. Describes the powerful and versatile methods of X-ray diffraction procedures which touch upon virtually every aspect of the metallurgical practice. Includes references to analogous neutron and electron diffraction procedures. A detailed description is given of the apparatus and experimental procedures required in the solution of real problems. The production of X-rays, X-ray absorption, and both X-ray and neutron radiography are discussed. ***A. Taylor.*** 993 pp. 1961. John Wiley, New York. (TN690 T21x)

* **Investigation of the Kinetics of Recrystallization of Cold-Formed Iron.** Specimens of armo-Fe subjected to plastic deformation of compression from 15 to 50% exhibited a linear dimension of the blocks of 0.4 mk. During the first stages of annealing at 600, 700, 800 and 890 C, there is a rapid, almost sudden increase of the dimension of the blocks up to 4 mk. With longer high temperature annealing a second growing stage of the blocks begins with features resembling diffusion mechanism. (*In Russian.*) Issledovanie kinetiki rekristallizatsii kholodnodeformirovannogo zheleza. ***B. Ia. Pines and E. F. Chaikovskii.*** *Fizika Metallov i Metallovedenie*, v. 11, no. 1, Jan. 1961, p. 34-39.

* **The Intermetallic Phases.** The essential properties of the Hume Rothery phases, of the Laves phases and of the σ-phases were defined. Electron concentration plays an important part in the stability of the Hume Rothery phases, while in the Laves phases it is the cutting factor. The σ-phases must be considered as intermediate between the solid solutions and the intermetallic phases. Only transition elements are involved by these phases. (*In French.*) Les phases intermétalliques. ***G. Collette.*** *Métaux Corrosion-Industries*, v. 36, Jan. 1961, p. 15-24.

* **Change in the Structure and Phase Composition of Some Austenitic Steels at the Incipient Stages of Decomposition Due to Cavitation.** First a plastic deformation occurs accompanied by phase transformations. As a result there is a breaking down of the blocks, an increase of their disorientation and a growth of the lattice deformations. During the formation of tetragonal martensite, of ϵ-phase and of low-dispersed carbides in the volume of the austenite grain, steel is strengthened and its resistance to decomposition due to cavitation is increased. (*In Russian.*) Izmenenie struktury i fazovogo sostava nekotorykh austenitnykh staleĭ na nachal'nykh stadiiakh kavitatsionnogo razrusheniia. ***I. N. Bogachev, R. Sh. Shkliar, L. D. Silusareva, R. I. Mints, and N. N. Siutkin.*** *Fizika Metallov i Metallovedenie*, v. 11, no. 1, Jan. 1961, p. 86-93.

Diffusion of Gold in Lead Single Crystals. Diffusion coefficients of Au in pure Pb single crystals have been measured by means of a radioactive-tracer method and sectioning technique over a wide range of annealing temperatures. ***A. Ascoli.*** *Institute of Metals, Journal*, v. 89, pt. 6, Feb. 1961, p. 218-220.

Nucleation and Growth of Twins in Dislocation-Free Zinc Crystals. Zinc whiskers and platelets with their largest faces in the basal plane and thin enough ($\sim \frac{1}{2}\mu$) to be transparent to 100 kV electrons were strained in tension inside the electron microscope and the nucleation and growth of twins observed by the transmission technique. These observations were then related to the various stages of stress-strain curves obtained in a high-sensitivity tensile machine. ***P. B. Price.*** *Royal Society, Proceedings*, v. 260, ser. A, Feb. 21, 1961, p. 251-262 + 7 plates.

* **Effects of the Ordering Processes and of Deformation on the Electrical Properties of a Nickel Silver of the Following Composition Cu_2NiZn.** Covers the changes in the electrical properties as functions of the annealing temperature and of the amount of deformation, the changes in the resistance during the tempering of undeformed and deformed specimens, a comparison between the change in hardness and the resistance during tempering, the behavior of the electrical values during phase modification, the effects of the vacancies on the electrical properties, and the kinetics of the ordering processes. (*In German.*) Der Einfluss von Ordnugsvorgängen und Verformung auf die elektrischen Eigenschaften einer Neusilber-Legierung der Zusammensetzung Cu_2 NiZn. ***G. Bartsch and B. Tehnzen.*** *Metall*, v. 15, Feb. 1961, p. 127-136.

* **The Manganese Distribution Between Iron Melts and Iron(II) Oxide Slags in the MnO Crucible From 1520 to 1700°C.** Allowing for the partial O pressure in the furnace

atmosphere, the melting point of the Mn(II) oxides was determined at 1875 C ± 25 C. The equilibrium diagram of the Fe(II) oxide-Mn(II) oxide was examined. The liquidus line of this system was determined up to 30% MnO and between 1370 and 1510 C. Debye-Scherrer pictures of the FeO-MnO slags exhibited a continuous change of the lattice constants of the Fe(II) oxide with increasing MnO content in the slags. (*In German.*) Die Manganverteilung zwischen Eisenschmelzen und Eisen(II)-oxydschlacken im MnO-Tiegel bei 1520 bis 1770°C. ***Wilhelm Anton Fischer and Hans Joachim Fleischer.*** *Archiv für das Eisenhüttenwesen*, v. 32, no. 1, Jan. 1961, p. 1-10.

* **The Recrystallization of Zinc by Thermic Cycles.** Experiments have been carried out on zinc specimens of equal purity (99.9%), but different history (cast, annealed, rolled) and under certain conditions, up to the formation of monocrystals. Experimental results show the influence of variables of the cycle on the grain growing speed and on the development of the phenomenon. (*In Italian.*) La ricristallizzazione dello zinco per ciclaggio termico. ***D. Buttinelli and G. de Gregorio.*** *Metallurgia Italian*, v. 52, Dec. 1960, p. 835-841.

* **The Skin Thickness and the Sulphur Distribution in Rimmed Steel Ingots.** To broaden the knowledge of the different variables which may control both of the above factors, research has been carried out which allows one to clarify both the relationship existing between skin thickness and rimming type and the dependence of distribution pattern of S in ingots from the modalities of rimming and from the size of ingots themselves. (*In Italian.*) Lo spessore di pelle e la distribuzione del solfo nei lingotti di acciaio effervescente. ***G. Odone and A. Filippini.*** *Metallurgia Italiana*, v. 52, Dec. 1960, p. 786-794.

* **Hydrogen in Pig Iron.** After explaining operative directions (selection of sample, preparation, gas extraction and analysis) the results obtained are presented and checked in an attempt to determine the diffusion laws of H at different temperatures. Gives some observations on the work carried out. (*In Italian.*) L'idrogeno nelle ghise. ***M. Ferrero and G. Timo.*** *Metallurgia Italiana*, v. 52, Dec. 1960, p. 779-785.

* **Structural Changes in Cast Iron by Heat Treatment in the Solid State.** Studies the proportions of the phases in the stable and in the mestastable system, Fe-C and Fe-Fe_3C; determines the differences of the ternary constitutional diagrams of Fe-FeSi-Fe_3C and Fe-FeSi-C, and the effects of the Si content on the rate of decomposition of the austenite, describes the austenite-martensite transformation and heat treatment for the purpose of a finer distribution of graphite. (*In German.*) Gefügeänderunge in Gussesisen durch Wärmebehandlung im festen Zustand. ***Werner Jellinghaus.*** *Giesserei, Technisch-Wissenschaftliche Beihefte*, no. 31, Jan. 1961, p. 1-18.

* **Measurement of the Self-Diffusion in Alpha Iron as Well as of the Diffusion of Cobalt 60 in Alpha Iron.** Laws of diffusion and diffusion mechanisms. Methods used for the measurement of self-diffusion. Measuring equipment and test specimen manufacture. Measuring results. Measuring errors. Discussion of measuring results and comparison with data obtained by other authors. Discussion. (*In German.*) Messung der Selbstdiffusion in α-Eisen sowie der Diffusion von Kobalt-60 in α-Eisen. ***Werner Lange, Alfred Hässner, and Erwin Dahn.*** *Neue Hütte*, v. 6, Jan. 1961, p. 33-44.

Effect of Hydrogen on Room-Temperature Properties of Titanium-Low-Aluminium-Low-Manganese Alloys. Tensile tests, at three strain rates, and Izod tests have been made on alloys containing 0.5, 1.5, and 2.5% each of aluminum and manganese and up to 200 ppm hydrogen, annealed for 1 hr. at 800 C and furnace-cooled. Hydrogen caused embrittlement of the alloys in the Izod test, but this was less severe the higher the alloy content. ***R. Haynes.*** *Institute of Metals, Journal*, v. 89, pt. 7, Mar. 1961, p. 249-252.

On the Metastable γ-Phase Uranium-Molybdenum Alloys. The experimental data of Chandrasekhar and Hulm (resistivity), of Berlincourt (Hall effect), and of Goodman, et al. (specific heat) are examined within the framework of the band model suggested by Friedel. It is shown that all available data are consistent with a reasonable density of states curve, and the qualitative features of that curve are in agreement with those deduced by Friedel from the properties of pure U. ***F. J. Blatt.*** *Physics and Chemistry of Solids*, v. 17, nos. 3-4, Jan. 1961, p. 177-187.

The Stability of a Tetragonal Phase Gamma Prime in Uranium-Niobium Alloys. A re-examination. ***J. D. Browne and G. K. Williamson.*** *Institute of Metals, Journal*, v. 89, pt. 7, Mar. 1961, p. 246-247.

The Influence of Dislocations on the Microstructure of Some Titanium Alloys. Influence by the number and arrangement of dislocations present, owing to nucleation and growth of a second phase on the dislocation sites. ***T. H. Schofield.*** *Institute of Metals, Journal*, v. 89, pt. 7, Mar. 1961, p. 235-237.

* **The Effect of Niobium on Properties of 18 Chromium-12 Nickel Austenitic Stainless Steels.** Concerns mechanical properties such as creep rupture strength, tensile strength, impact value, deformation resistance at high temperature and aging hardness, as well as on the microstructure of austenitic stainless steels. ***Ryuichi Nakagawa and Yasuo Otoguro.*** *National Research Institute for Metals, Transactions*, v. 2, no. 2, 1960, p. 63-68.

* **The Mode of Precipitation in Aluminium-Magnesium Alloys.** Above was studied by the metallographic method and X-ray measurement. Alloys were aged at 170, 200 and 250 C for various periods of time. ***Shigeru Matsuo.*** *National Research Institute for Metals, Transactions*, v. 2, no. 2, 1960, p. 84-88.

* **A Study of Fatigue Deformation by Reflection Electron Microscopy.** ***G. Thomas, N. P. Sandler, and I. Cornet.*** *Institute of Metals, Journal*, v. 89, pt. 7, Mar. 1961, p. 253-254.

* **The Problem of Ferritic Phase in Austenitic Acid-Resisting Steels.** The amount of ferritic phase depends on the chemical composition. It is definitely influenced by the heat treatment. The ferritic phase does not hinder the hot plastic transformation of acid-resisting steels, rolled into rods and strips. The amount of Ni must be reduced as much as possible. Acid resisting steels for pipe production must have a restricted amount of ferritic phase. (*In Polish.*) Zagadnienie fazy ferrytycznej w austenitycznych stalach kwasoodpornych. ***Henryk Serwicki, Henryk Brudzewski, and Edmund Karch.*** *Hutnik*, v. 28, no. 2, Feb. 1961, p. 51-55.

* **Investigations of the Tantalum-Aluminum-Silicon and Tungsten-Aluminum-Silicon Systems.** The structure of Ta-Al-Si alloys was determined between 20 and 80 at.% Si and 10 to 75 at.% Al. In binary Ta-Al system, the $TaAl_3$ phase was confirmed; a further crystal type between 33 and 50 at.% Ta and the existence of an σ-phase with a wide homogeneous region (64 to 80 at.% Ta) were determined. The distribution of the phase fields in W-Al-Si alloys up to 70% Si and 79 at.% Al is characterized by the existence of the ternary mixed phase with C 40 structure. (*In German.*) Untersuchungen in den Systemen Tantal-Aluminium-Silicium und Wolfram-Aluminium-Silicium. ***H. Nowotny, C. Brukl, and F. Benesovsky.*** *Monatshefte für Chemie*, v. 92, no. 1, Feb. 28, 1961, p. 116-127.

METALS—POWDER

* **Contact Heat Exchange Between Metal Powder Surfaces.** Determination of contact thermal resistances between metal powders and between metal powder and metal under various conditions of contact. (*In Ukrainian.*) Kontaktnyyi teploobmin mizh metalokeramichnymy poverkhniamy. ***V. S. Miller.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1961, no. 1, p. 40-43.

* **Study of the First Stage of Natural Sintering in γ-Phase of Uranium Powder by Isothermal Dilatometry.** The compacts obtained from unalloyed U powder exhibited a certain contraction during thermal treatments in γ-phase. The dilatometric study of this contraction at different temperatures made it possible to determine the probable mechanism of the first stage of sintering of these compacts, and the heat of activation of the process. (*In French.*) Étude du premier stade du frittage naturel en phase γ de la poudre d'uranium par dilatométrie isotherme. ***Bernard Pinteau, Georges Cizeron, and Paul Lacombe.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 252, no. 8, Feb. 20, 1961, p. 1149-1151.

Today's Five Trends in Powder Metallurgy. Surveys prealloyed powders, coated powders, large parts, composite structures, and magnetic alloys. ***Donald Peckner.*** *Materials in Design Engineering*, v. 53, no. 4, Apr. 1961, p. 111-115.

* **The Powder Metallurgy of Ruthenium.** Ammonium ruthenium chloride was reduced and formed into sintered compacts. ***R. G. Cope and D. W. Rhys.*** *Powder Metallurgy*, no. 7, 1961, p. 139-155.

* **Techniques for the Evaluation of Powders. I. Fundamental Properties of Particles and Methods of Sizing Analysis. II. The Bulk Properties of Metal Powders. III. Observations on Compacts.** Describes the essential features of methods for the sizing analysis of powders, with brief consideration of their characteristics and some indication of recent tendencies in the application of electronic devices and automatic recording. Current methods of sampling and determination of flow, apparent and tap density, particle size, "fillability", and "hydrogen loss" are reviewed. Properties of compacts are discussed under four headings: behavior during pressing, properties of the green compact, behavior during sintering, and the properties of the sintered compact. I. ***Harold Heywood.*** II. ***P. R. Marshall.*** III. ***V. T. Morgan.*** *Powder Metallurgy*, no. 7, 1961, p. 1-65.

* **Titanium-Aluminium-Manganese Alloys Prepared by Powder-Metallurgical Techniques.** The preparation of titanium hydride powder and the method of adding Al and Mn are described. Sintered materials had poor ductility and this is attributed to the presence of an acicular structure. The tensile strength and ductility of sintered and forged alloys, in which the acicular structure is destroyed, were as good as, and in some cases superior to, those of the equivalent conventional cast and wrought alloy. Both the sintered and the sintered-and-forged material exhibited good creep properties at 200 and 400 C. Attempts to destroy the acicular structure of the sintered alloy by heat-treatment were unsuccessful. ***M. F. Grimwade.*** *Powder Metallurgy*, no. 7, 1961, p. 283-295.

* **Measurement of the Surface Area of Powders by the BET Method.** Some experimental aspects of the construction and use of a conventional BET apparatus are discussed. Some improvements in the method of measuring adsorption and in the size of the equipment resulted in the development of the "micro BET" apparatus. ***B. C. Lippens and M. E. A. Hermans.*** *Powder Metallurgy*, no. 7, 1961, p. 66-81.

* **A Comparative Study of Methods for Particle-Size Analysis in the Sub-Sieve Range.** Eleven powders of widely different properties (various grades of WC, WO_3, W, Fe, Co, SiO_2, Al_2O_3), considered typical of the raw materials encountered in powder metallurgy, were studied by "single-value methods" [apparent and tap density, air permeametry, gas adsorption (BET)] and by "size-distribution methods" (electron- and light-microscope sizing, turbidimetry, sedimentation balance, centrifugal air classification, and sieve analysis). A series of WC powders having varying degrees of fineness was studied by air permeametry, gas adsorption, optical reflectivity, turbidimetry, and sedimentation in air, to assess the reliable working ranges of these methods. ***H. F. Fischmeister, C.-A. Blände, and S. Palmqvist.*** *Powder Metallurgy*, no. 7, 1961, p. 82-119.

Producing Powder Metallurgy Parts. Shows how parts are designed with powder-metallurgy production in mind and explains special tooling. ***P. V. Schneider.*** *Tool and Manufacturing Engineer*, v. 46, no. 5, Apr. 1961, p. 81-86.

* **Production and Utilization of Cobalt Powders.** Reviews the different production methods for cobalt powders which have reached the industrial, or at least semi-industrial, stage and a short account of the present fields of application of cobalt powders, excluding, however, all cobalt-containing alloy powders. ***E. De Bie and P. Doyen.*** *Cobalt*, no. 10, Mar. 1961, p. 22-32.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

Nondestructive Testing. Covers the broad range of the field—from visual testing, pressure and leak testing, and liquid penetrant inspection, to thermal methods, dynamic testing, and thickness measurements. Discusses the advantages and disadvantages of X-ray radiography; gamma radiography; ultrasonics; and magnetic, electrical, eddy current, and other methods as working tools of nondestructive testing. ***Warren J. McGonnagle.*** 455 pp. 1961. McGraw-Hill, New York. (TA410 M17n)

* **Nondestructive Testing Can Save You Time and Money.** Cites advantages in process development and control, receiving inspection, and final inspection. ***Robert B. Oliver.*** *Welding Design and Fabrication*, v. 34, Mar. 1961, p. 51 + 9 pages.

* **Welding Aluminum. X. Quality Control.** Covers inspection and testing of welded joints; weld faults, their causes and probable corrective measures. *Modern Metals*, v. 17, no. 1, Feb. 1961, p. 58 + 3 pages.

* **Honeycomb Panels X-Rayed.** Designed for the B-70 intercontinental bomber. *Metalworking Production*, v. 105, no. 7, Feb. 15, 1961, p. 72.

* **Inspecting Pipe Welds With Ultrasonics.** Fast, accurate ultrasonic techniques now effect successful in-process testing. ***Theodore Manis and Walter M. Smith.*** *ISA Journal*, v. 8, Mar. 1961, p. 56-59.

* **Non-Destructive Testing of Steel Castings by Means of Ultrasonic Waves.** General description. (*In German.*) Zerstörungsfreie Werkstoffprüfung von Stahlguss mit Ultraschall. ***Alfred Kolorz.*** *Giesserei*, v. 48, no. 5, Mar. 9, 1961, p. 109-114.

* **Recommended Practices Concerning Radiographic Image Quality Indicators (I.Q.I.).** Recommends that use be made of two types of I.Q.I. only: the wire-type indicator or the hole-type indicator. (*In French.*) Pratiques recommandées concernant les indicateurs de qualité d'image radiographique (I.Q.I.). *Soudage et Techniques Connexes*, v. 15, nos. 1-2, Jan.-Feb. 1961, p. 39-42.

Ultrasonic Testing of Sheet, Plate, Welds, and Tubing. Survey of present status. ***W. Grabendörfer and H. Weber.*** *Henry Brutcher Translation No.* 4875, 18 pp. (From *Industrie-Anzeiger*, v. 82, no. 50, June 21, 1960, p. 775-780.) Henry Brutcher, Altadena, Calif.

* **The Radiographic Examination of a Thin Object.** Shows that components of low stopping-power may be radiographically examined by using fairly soft X-rays. ***C. Casswell and E. Eisner.*** *Nondestructive Testing*, v. 19, no. 2, Mar.-Apr. 1961, p. 108-109.

* **Nondestructive Testing in Component Manufacturing.** Application of these techniques and using them not only for an inspection of the product, but for the establishment of a feed-back loop so that proper process control may be maintained. ***A. J. Heitner and C. D. Cherryholmes.*** *Nondestructive Testing*, v. 19, no. 2, Mar.-Apr. 1961, p. 113-115.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

S- and P-Wave Interactions of K^- Mesons in Hydrogen. Scattering and hyperon-production cross sections are measured at mean K^--meson laboratory momenta of 300 Mev/c and 400 Mev/c. ***Paul Nordin, Jr.*** *U. S. Atomic Energy Commission, UCRL*-9489, Nov. 21, 1960, 40 pp. (UF767 U3u Contin.)

* **Total Neutron Cross Sections for Intermediate Nuclei Around 4 MeV.** A study of the region $20 < A < 40$ where there was not a good fit of the optical model predictions with the few experimental data available. ***R. Ricamo.*** *Helvetica Physica Acta*, v. 33, no. 9, 1960, p. 997-1002.

* **Thermal Utilization Factor in Water-Graphite Moderated Lattice.** Modification of the standard two-group method based on the assumption of non-zero neutron current at the boundary of the cell is given. ***Antoni Kuszell and Janusz Miks.*** *Nukleonika*, v. 5, no. 11, 1960, p. 743-754.

Trends in Materials for Reactor Control Rods. Hafnium still maintains its position as the most widely used control material, but the performance of rods made from a Cd-In-Ag alloy and a stainless steel containing B are being investigated in commercial reactors. ***J. B. Giacobbe.*** *Metal Progress*, v. 79, no. 3, Mar. 1961, p. 105-106.

Design and Manufacture of Reactor Vessels. Difficulties arise from ignorance about radiation damage to steel and welds, from laminations and inhomogeneities in the plate, from lack of standardized test and inspection methods, and from quite limited experience with operating reactors. ***D. K. Davies.*** *Metal Progress*, v. 79, no. 3, Mar. 1961, p. 101 + 7 pages.

* **Reactor Core Materials.** A review of recent developments prepared by Battelle Memorial Institute. A cumulative index for Volumes 1 to 3 of *Reactor Core Materials. Reactor Core Materials*, v. 3, no. 4, Nov. 1960, 100 pp.

* **Trawsfynydd Nuclear Power Station.** Includes a detailed drawing of the station. *Overseas Engineer*, v. 34, Mar. 1961, p. 241-243.

* **Measuring the Evaporation of Oxide Cathodes in Electron Tubes by Means of Radioactive Isotopes.** The oxides involved are Ba and Sr of the order of 10^{-6} to 10^{-7} gram. These small amounts may be easily measured by means of Ba-140 and Sr-89 without the necessity of making any analytic separations whatsoever. Taking commercial electron tubes as example, the practical value of this method is shown. (*In German.*) Messung der Oxydkatodenverdampfung in Elektronenröhren mit radioaktiven Isotopen. ***Ch. Rösszler.*** *Nachrichtentechnik*, v. 11, no. 1, Jan. 1961, p. 13-16.

* **Linear Amplifiers in Nuclear Physics I. I. General Problems Relative to the Amplification of Pulses of Nuclear Beam Detectors.** For spectrometrical measurements, such amplifiers must meet certain requirements with regard to linearity, stability, and frequency response of the amplification factor. (*In German.*) Linearverstärker in der Kerntechnik I. I. Allgemeine Probleme bei der Verstärkung von Impulsen kernphysikalischer Strahlendetektoren. ***R. Gärtner.*** *Nachrichtentechnik*, v. 11, no. 1, Jan. 1961, p. 17-27.

Interfacial Area Measurement in Liquid-Liquid Systems by Radioisotopes. II. The Use of a Liquid Scintillator. Short-range alpha particles produce light scintillations in the organic phase within a few microns of the liquid interface, which are detected by a photomultiplier, analyzed by appropriate pulse circuitry, and counted. ***C. V. Chester and J. S. Newman.*** *U. S. Atomic Energy Commission, ORNL*-3018, Feb. 3, 1961, 25 pp. (UF767 U3o Contin.)

Cold Neutron Beams From Small Low-Temperature Moderators in Reactors. Shows that several hydrogenous liquids and solids are equally efficient as low-temperature moderators. As long as the neutron mean free path is much smaller than the dimensions of the moderator chamber, the cold neutron flux can be increased by a factor of 5. ***F. J. Webb.*** *Nuclear Science and Engineering*, v. 9, Feb. 1961, p. 120-126.

Fast-Flux Measurements in the ORR Core. The axial neutron flux distributions for thermal, 0.70 Mev and 2.9 Mev, were measured using Co^{59}, Np^{237}, and S^{32}, respectively. ***P. Dragoumis, J. R. Weir, Jr., and G. W. Leddicotte.*** *U. S. Atomic Energy Commission, ORNL*-3028, Feb. 7, 1961, 46 pp. (UF767 U3o Contin.)

* **Proceedings of the Second Accelerator Conference.** Covers the conference on low-energy accelerators which was held in Amsterdam on Oct. 4, 5, and 6, 1960. Papers are divided into sections on nuclear physics, particle research, and physics and radiation research. ***K. Siegbahn, editor.*** *Nuclear Instruments and Methods*, v. 11, Jan. 1961, 256 pp.

Radiochemical Study of the Ranges in Metallic Uranium of the Fragments From Thermal Neutron Fission. Mean ranges in U of 28 fission products have been determined by radiochemical measurement of the fraction escaping from the surface. Several factors affecting the precision and accuracy of the method are discussed. ***James B. Niday.*** *Physical Review*, v. 121, 2nd ser., no. 5, Mar. 1, 1961, p. 1471-1483.

An Approach to Reactor Physics Using Results of Integral Experiments. The developed procedure is extremely simple, and it is demonstrated that the thermal utilization factor and resonance escape probability can be calculated to satisfactory accuracy. ***Karl H. Puechl.*** *Nuclear Science and Engineering*, v. 9, Feb. 1961, p. 241-259.

Radiation Damage in Steel: Considerations Involving the Effect of Neutron Spectra. The mechanism of interaction between fast neutrons and atoms of a metal lattice is described. A cross section for the production of vacancies in iron by neutrons, as a function of neutron energy, is derived and shown to be roughly proportional to the product of the neutron energy and the isotropic elastic-scattering cross section. ***A. D. Rossin.*** *Nuclear Science and Engineering*, v. 9, Feb. 1961, p. 137-147.

* **New Nuclear Aids to Process Control.** Instruments designed for continuous measurement and control of moisture and density of materials on conveyor belts, in pipes, in bins and hoppers, and in tanks, mixers and blenders. ***F. R. Paulsen.*** *Nuclear Energy*, Feb. 1961, p. 64-65.

* **Design of Heat Exchangers for Nuclear Power Plants.** ***B. F. Ridal and J. H. Wilson.*** *Chemical & Process Engineering*, v. 42, Feb. 1961, p. 55-58.

* **A Comparison of Stainless Steel and Zirconium For Use in Pressurized Water Reactors.** Advantages and disadvantages of Zr-2 and SS cores using fully enriched U have been compared. It shows that SS cores are considerably cheaper (about 40%) to buy than Zr-2 cores, that SS possesses greater resistance to hydride formation and better mechanical properties both in irradiated and unirradiated conditions, and that SS can be used in very compact core while U-Zr alloys cannot. However, SS cores are reactivity limited (i.e., require a considerably larger critical mass) and present a more serious activity buildup problem than Zr cores. The possibility of considerably increasing the life of a core by using Zr-2 instead of SS is the most important advantage of the U-Zr type cores. The activity buildup problems are also very important considerations which cannot be overlooked when comparing the two types of cores. ***Charles J. Baroch.*** *Mines Magazine*, v. 51, Feb. 1961, p. 17-22.

* **Geometrical Representation of Nuclear Properties.** Method allows a comprehensive survey of nuclear properties and a more direct comparison with theoretical results. ***M. Beiner and K. Bleuler.*** *Nuclear Physics*, v. 22, no. 4, Feb. 1961, p. 589-597.

* **Nuclear Octupole Deformation and the Mechanism of Fission.** Finds that the interaction of levels of opposite parity makes the nuclei in certain regions very soft to octupole deformation. The negative parity collective states in heavy nuclei and in the rare earth region can be interpreted as octupole vibrations. ***Sven A. E. Johansson.*** *Nuclear Physics*, v. 22, no. 4, Feb. 1961, p. 529-552.

Burying Radioactive Wastes. Reports a promising technique for forcing the wastes, as radioactive cement, into permanent resting places in underground shales. ***Ritchie Calder.*** *New Scientist*, v. 9, Feb. 9, 1961, p. 322-324.

Materials for Nuclear Engineers. Aims to provide both the best available data and a sufficient discussion of the theoretical background to enable the reader to get a feel for the characteristics of the material and a knowledge of the extent to which interpolation and extrapolation can sensibly be used to avoid further research and development studies. Individual chapters concentrate on the behavior and properties of U, Th, Pu, ceramic fuels, graphite, Mg, Be, and Zr. All authors of the individual chapters are members of the staff of the United Kingdom Atomic Energy Authority who are or have been primarily engaged on the study and selection of materials and who are in day-to-day contact with the engineering side of that organization. ***A. B. McIntosh and T. J. Heal.*** 373 pp. 1960. Interscience Publishers, New York. (TK9202 M18m)

A Study of the Reactions $^{12}C(^3He, n)^{14}O$ and $^{16}O(^3He, n)^{18}Ne$. The time-of-flight and slow-neutron threshold techniques in conjunction with ^3He particles of energies of up to 11 Mev, have been used to measure the Q value of the $^{16}O(^3He, n)$ reaction and to locate levels in ^{18}O and ^{18}Ne. ***J. H. Towle and B. E. F. Macefield.*** *Physical Society, Proceedings*, v. 77, pt. 2, Feb. 1961, p. 399-416.

The Elastic Scattering of ^3He by C, Mg, Al, and Cu. Angular distributions of 5.5 Mev ^3He particles elastically scattered by C, Mg, Al, and Cu have been measured by magnetic analysis at angles of observation between 20 and 132.5°. ***G. Parry, H. D. Scott, and S. Swierszczewski.*** *Physical Society, Proceedings*, v. 77, pt. 2, Feb. 1961, p. 230-233.

* **Production of Lu^{178} by the $Ta^{181}(n, \alpha)Lu^{178}$ Reaction in the NRX Reactor.** ***P. Glentworth and R. H. Betts.*** *Canadian Journal of Physics*, v. 39, Mar. 1961, p. 381-384.

* **Fermions and the Intrinsic Pauli Principle.** An approach to the problem of classification of elementary fermions proposed previously is summed up. ***Wojciech Królikowski.*** *Nuclear Physics*, v. 23, no. 1, Feb. 1961, p. 53-61.

* **Promethium-148.** Promethium-148 has been produced by two methods. In both instances two activities were observed. ***J. S. Eldridge and W. S. Lyon.*** *Nuclear Physics*, v. 23, no. 1, Feb. 1961, p. 131-138.

* **Notes on the Theory of Vibrational States of Systems of Fermions (I).** The system of nonlinear equations for the components of the single particle density matrix operator is discussed, for both infinite and finite systems of fermions interacting through a two-body "residual" interaction. ***J. Sawicki.*** *Nuclear Physics*, v. 23, no. 2, Feb. 1961, p. 285-295.

* **Shell-Model Analysis of Calcium Isotopes.** An intermediate shell model calculation is made for Ca-42 and Ca-43. The effective two-body (static) internucleon potential, acting among the neutrons outside the Ca-40 core, is phenomenologically obtained by fitting the known energy levels of 42 and 43. ***Henri E. Mitler.*** *Nuclear Physics*, v. 23, no. 2, Feb. 1961, p. 200-244.

* **Investigation of the SR-1 Heterogeneous Subcritical Assembly.** Results of experiments with cylindrical fuel elements (enriched in U-235 to 10%) and distilled water are reported. (*In Russian.*) Issledovanie geterogennoĭ nodkoiticheskoĭ systemy SR-1. ***L. Pál, F. Szabó, Z. Gyimesi, L. Bata, and L. Turi.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 12, no. 3, 1960, p. 205-219.

* **Nuclear Reactors for Economic Power. A Review of Present Technology.** Describes advanced designs of a number of well established power reactor types as well as their technical and economical problems and gives the most appropriate references for each type. Contains 100 references. ***Zeev Pelled.*** *Research Council of Israel, Bulletin*, v. 8C, no. 2, June 1960, p. 63-78 + 18 figures.

Sodium Reactor Operating Experience. Sodium-graphite reactors being designed offer promise of competing with conventional power plants. ***R. E. Durand.*** *Chemical Engineering Progress*, v. 57, Mar. 1961, p. 54-59.

Boiling Water Reactor. Experience obtained from the experimental boiling water reactor shows a minimum of operation and maintenance problems which will contribute to the development of large-scale designs. ***Edward A. Wimunc.*** *Chemical Engineering Progress*, v. 57, Mar. 1961, p. 50-53.

Operation of the Shippingport Atomic Power Station. Pressurized water reactor operation provides answers to integration of nuclear stations into utility systems. ***F. C. Duvall.*** *Chemical Engineering Progress*, v. 57, Mar. 1961, p. 46-49.

Debris From Tests of Nuclear Weapons. Activities roughly proportional to volume are found in particles examined by autoradiography and microscopy. ***Jan Sisefsky.*** *Science*, v. 133, Mar. 17, 1961, p. 735-740.

Plutonium Extraction From Nitrate and Sulfate Solutions by Amines and Organophosphorus Compounds. Plutonium extraction coefficients from acid nitrate and sulfate solutions by amines and some neutral and acid organophosphorus compounds were measured as functions of several extraction variables, including Pu valence, acid and salt concentration, and extractant concentration. ***D. E. Horner and C. F. Coleman.*** *U. S. Atomic Energy Commission, ORNL-3051*, Mar. 9, 1961, 64 pp. (UF767 U3o Contin.)

* **Triple Spontaneous Division of Curie-242.** (*In Russian.*) O troĭnom spontannom delenii Kiuriia-242. ***N. A. Perfilov, Z. I. Solov'eva, R. A. Filov, and G. I. Khlebnikov.*** *Akademiia Nauk SSSR, Doklady*, v. 136, no. 3, Jan. 21, 1961, p. 581-582.

* **The Range of Na^{24} Ions of Kiloelectron Volt Energies in Aluminum.** Reports the depth of penetration in Al of nonoenergetic Na^{24} ions over the energy region 0.7-60 kev. ***J. A. Davies and G. A. Sims.*** *Canadian Journal of Chemistry*, v. 39, Mar. 1961, p. 601-610.

* **The Design of Irradiation Experiments.** For fuel specimen tests the six important variables are geometry, enrichment, surface flux (flux depression calculation), flux distribution in specimen, heat rating and radial temperature drop. Because these variables are all interrelated, it is impossible to choose all independently. Five experiments are discussed by the authors. ***J. R. Atkinson.*** *Chartered Mechanical Engineer*, v. 8, no. 2, Feb. 1961, p. 103-104.

The E X B Discharge as a Source of Ions. For standard applications, this use appears limited because the ions obtain energy while still within the arc structure. The E X B geometry also operates as an effective ion pump for light gases. ***Kenneth W. Ehlers.*** *U. S. Atomic Energy Commission*, UCRL-9503, Jan. 10, 1961, 26 pp. (UF767 U3u Contin.)

Effect of Specific Power on Fuel Reactivity and Costs in Thorium-Fueled Reactors. It was found that the most important specific power effect on fuel reactivity is the holdup of Pa^{233}, rather than its burnout to U^{234}. Using conventional cost bases, the effect of specific power on the fuel costs for Th fueled reactors has been shown to be small in the range of practical specific powers. ***E. A. Mason and J. A. Larrimore.*** *Nuclear Science and Engineering*, v. 9, Mar. 1961, p. 332-340.

Circulating Fused-Salt Fuel Irradiation Test Loop. A compact forced-circulation test loop for obtaining corrosion data applicable to molten-salt-fueled reactors has been operated in the MTR (HB-3) beam hole. Several tests were conducted with two fused-salt mixtures. ***D. B. Trauger and J. A. Conlin, Jr.*** *Nuclear Science and Engineering*, v. 9, Mar. 1961, p. 346-356.

* **Plutonium and Its Metallurgy. A Stage in Its Development: The International Conference on the Metallurgy of Plutonium (Grenoble, April 1960).** Physical properties of Pu, allotropic variations; kinetics of transformation. Plutonium can be used only as nuclear fuel; it is very expensive; this metal is also very toxic. Its performance should now be studied and compared with that of natural or enriched U. (*In French.*) Le plutonium et sa métallurgie. Une étape: Lo conférence internationale sur la métallurgie du plutonium (Grenoble, Avril 1960). ***E. Grison.*** *Revue de Métallurgie, Mémoires Scientifiques*, v. 58, no. 1, Jan. 1961, p. 1-10.

* **Tightness Tests on Reactor Safety Pressure Shells.** Describes and critically compares various methods of examination. The examples of the tightness tests carried out with the pressure shells of the research reactors DIDO and MERLIN are used to indicate the problems arising in the field of instrumentation. (*In German.*) Dichtheitsuntersuchungen an Reaktor-Sicherheitsdruckschalen. ***K. Jaroschek and E. Weippert.*** *Brennstoff-Wärme-Kraft*, v. 13, Mar. 1961, p. 105-115.

Niobium-20 w/o Uranium, High-Temperature Metallic Fuel of the Future. An alloy containing Nb-20 w/o U has been developed for reactor fuel applications. The fabrication characteristics, mechanical properties, and corrosion behavior in air, CO_2, NaK, water, and steam were studied. After consumable-arc melting, the alloy was successfully forged at 1370 C and rolled at 980 C to sheet. Representative specimens of this alloy showed only slight reductions in hardness up to 900 C. The 0.2% offset yield strength was 93,000 psi at 24 C and 71,000 psi at 870 C. At a stress of 63,000 psi at 870 C, 200 hr were required to cause rupture. Other metallurgical data are listed. ***John A. De Mastry, Frederic R. Shober, and Ronald F. Dickerson.*** *Nuclear Science and Engineering*, v. 9, Mar. 1961, p. 299-304.

OPERATIONS RESEARCH

* **The Science and Values of Administration. II.** Concerns administration as an applied science. ***Alfred de Grazia.*** *Administrative Science Quarterly*, v. 5, no. 4, Mar. 1961, p. 536-582.

* **Hierarchy, Specialization, and Organizational Conflict.** The combination in modern bureaucracy of technological specialization and the older institution of hierarchy has produced an organizationally determined pattern of conflict in modern organization. It is caused by the growing gap between authority and perception of technical needs, these two elements of organization being largely now in the hands of two separate sets of officials. ***Victor A. Thompson.*** *Administrative Science Quarterly*, v. 5, no. 4, Mar. 1961, p. 485-521.

Laboratory Management and Techniques. A handbook on technical laboratory management, from the vast experience of a top laboratory manager, who brings together within one volume a collection of information normally outside the curriculum of a university or technical college. This book will be of use to the many scientists and teachers who may be called upon to assist first in the planning of teaching and research laboratories and, later on, in their actual day-to-day management. ***J. A. Edwards.*** 207 pp. 1960. Butterworths, London. (Q183 Ed96L)

The Design and Analysis of Industrial Experiments. This is a sequel to Statistical Methods in Research and Production, 3rd edition, 1957, and has been published for Imperial Chemical Industries Ltd., which has long recognized that statistical methods are important in industrial research and production. As in the first book, the authors have been allowed to draw freely on information in I.C.I.'s possession, so that almost every example represents a problem which has been met in actual practice and for which full working details are given. Although the examples are chemical, the basic principles are explained in general terms and are capable of extension and application to other fields of industrial activity. ***Owen L. Davies, editor.*** 2nd Ed. 636 pp. 1960. Hafner Publishing Co., New York. (T175 D28d2)

* **Operations Research in National Planning of Underdeveloped Countries.** The problem of allocation of resources in development planning is treated in the form of a project-selection problem. ***Fred Hanssmann.*** *Operations Research*, v. 9, no. 2, Mar.-Apr. 1961, p. 230-248.

* **The Created Response Surface Technique for Optimizing Nonlinear, Restrained Systems.** This approach, called the *Created Response Surface Technique*, is based, essentially, on steepest ascents up a succession of created response surfaces within the solution space. The most important characteristic of the approach is that it automatically avoids restraint boundary violations during the optimization. This article discusses application to fully developed steady-state mathematical models. ***Charles W. Carroll.*** *Operations Research*, v. 9, no. 2, Mar.-Apr. 1961, p. 169-185.

* **Allocating for Acceptable Risk Instead of Expected Value.** Predictable adequacy of each operation is attained by considering the full distribution, e.g., of operating hours before failure, instead of just the mean (expected) value. Distributions with small standard deviations permit more precise prediction of probable time before failure (shortage). Plans based on marginal utility concepts tend to avoid the expected-value trap but do not necessarily minimize the appropriate risk of shortage. ***William S. Bennett.*** *Operations Research*, v. 9, no. 2, Mar.-Apr. 1961, p. 163-168.

* **Probability Based Tolerances in Forecasting and Planning.** The notions expressed in this paper have proved especially useful in connection with managing large-scale research and development programs. For example, similar concepts have been developed and successfully utilized in the Navy's computerized PERT system for the Polaris program. Flagle's paper, an untried concept when written five years ago, is now required reading for industrial engineers and managers. ***Charles D. Flagle.*** *Journal of Industrial Engineering*, v. 12, no. 2, Mar.-Apr. 1961, p. 97-101.

* **The Application of Manufacturing Improvement Curves in Multi-Product Industries.** This article aims to offer a practical, accurate and usable procedure to meet the need for a clear presentation of a correct, simple method for applying Manufacturing Improvement Curves to short run, multi-product industries. ***Paul F. Williams.*** *Journal of Industrial Engineering*, v. 12, no. 2, Mar.-Apr. 1961, p. 108-112.

* **Statistical Tolerance Limits for Determining Process Capability.** Calls attention to a means of directly determining the tolerance limits when the characteristic under study is approximately normally distributed. Techniques for determining tolerance limits, assuming a normal distribution, and assuming that the population average and standard deviation are *known* are used routinely in industry. The totality of these assumptions is usually very unrealistic. The methods given here do not make the assumption that the population values are known. ***W. Grant Ireson, George J. Resnikoff, and Barnard E. Smith.*** *Journal of Industrial Engineering*, v. 12, no. 2, Mar.-Apr. 1961, p. 126-131.

The Challenges to Engineering in the 1960's. Among the major challenges to the engineer in the next decade are increased emphasis on research and development, greater automation and mechanization of our manufacturing and administrative processes, and establishment of more manufacturing and service facilities abroad. ***D. G. Mitchell.*** *Electrical Engineering*, v. 80, Apr. 1961, p. 243-247.

* **Symposium on Military Operations Research.** The papers, by D. W. Meals, W. F. Whittemore and P. Osborn, place emphasis on the general rather than the technical, the practical rather than the theoretical, the *actual project effect* rather than the *mathematical framework* developed. ***Martin L. Leibowitz, editor.*** *Operations Research*, v. 9, no. 2, Mar.-Apr. 1961, p. 249-251.

Organizing Your Job in Management. Suggests that the key to executive efficiency is *organization*—of work, subordinates' assignments, and future planning. The executive who follows the program suggested in this handbook will be taking a big step toward becoming a better manager. ***Carl Heyel.*** 208 pp. 1960. American Management Association, New York. (HD38 H51o)

Managerial Performance Standards. The author of this AMA handbook believes that setting managerial performance standards is one of management's most valuable techniques. He describes a method for developing performance standards which can be applied by executives at every level. ***Virgil K. Rowland.*** 192 pp. 1960. American Management Association, New York. (HD38 R79m)

Use Information Departments for Selling. Inherent in the information reaching a company's intelligence department are business opportunities—if only they are recognized. ***Eric N. Simons.*** *Engineering*, v. 191, Mar. 17, 1961, p. 385.

ORE AND MATERIALS BENEFICIATION

* **Minerals Beneficiation.** Annual review. Discusses mill design; crushing and grinding; concentration; solids-liquid separation; chemical processing; operating control. ***Stephen E. Erickson, et al.*** *Mining Engineering*, v. 13, Feb. 1961, p. 173-178.

* **The Influence of the Addition of a Nonpolar Liquid on the Collecting Capacity of Cation Collectors in the Quartz Flotation Process.** (*In Polish.*) Wpływ dodatku cieczy apolarnej na zdolność zbierającą kolektorów kationowych w procesie flotacji kwarcu. ***Andrzej Waksmundzki and Anna Barcicka.*** *Przemysł Chemiczny*, v. 39, no. 12, Dec. 1960, p. 773-776.

Have Flotation, Will Separate! Describes froth flotation which has become one of the major concentration processes in the past 50 years. ***Roshan B. Bhappu.*** *Mines Magazine*, v. 51, Feb. 1961, p. 35-40.

The Hydrogen Reduction of a Low-Grade Siliceous Iron Ore. Particle size has no observable effect except in the smaller fractions at 900 C and above, where reduction is impeded, possibly due to the siliceous nature of the ore. ***Franklin J. Hill and Theodore D. Tiemann.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 221, no. 1, Feb. 1961, p. 68-72.

* **Copper Concentrates to Metal Shapes in Marinduque's New Philippine Plant.** Eliminates all smelting for first time by chemical leaching, gaseous reduction to powder, and use

of new rolling techniques. ***George O. Argall, Jr.*** *Mining World*, v. 23, no. 3, Mar. 1961, p. 31-33.

* **Reducibility of Salem Magnetite Ore.** Attempts to assess reducibility based on H reduction of lumps and briquettes at temperatures varying from 700 to 1000 C. Reduction rate has been observed to slow down considerably after 70% of reduction is completed. Experiments show that reduction of the ore concentrates compares favorably with that of high grade haematite iron ores used in India at present for iron production. ***M. Subramaniam and P. P. Bhatnagar.*** *Journal of Scientific & Industrial Research*, v. 19A, Dec. 1960, p. 620-624.

German Procedures for the Enrichment of the Uranium Isotope. The gaseous diffusion method, the nozzle separation method, and the gas centrifuge method are treated and their economic prospects are compared. ***W. Groth.*** *U. S. Atomic Energy Commission, GAT-Z-5016*, Nov. 7, 1960, 16 pp. (UF767 Un3.1ga Contin.)

Mineral Processing. Sets out in an up-to-date manner the basic principles which underlie sound milling practice and shows their relation to standard commercial operations. ***Edmund James Pryor.*** 2nd Ed. 814 pp. 1960. Mining Publications, Ltd., London. (TN500 P95i2)

* **Coal Preparation for Consistent Standards. Its Importance to Efficient Handling and Combustion.** Describes the extensive methods and research which are involved to ensure consistent qualities of coal. ***E. Otty.*** *Fuel Efficiency*, v. 9, Mar. 1961, p. 61-62.

* **Flotation of Potassium Chloride From the Wastes of the Cold Decomposition of Kłodawa Carnallite.** Investigated how the quantity of collector (a mixture of hydrochlorides of aliphatic amines with 12-14 carbon atoms) affected the yield of KCl and the selectivity of salt minerals. (*In Polish.*) Flotacja chlorku potasowego z odpadów po rozkładzie na zimno karnalitu kłodawskiego. ***Wiesław Długosz and Grzegorz Maksymiuk.*** *Przemysł Chemiczny*, v. 40, no. 1, Jan. 1961, p. 51-54.

Economic Justification for Froth Flotation of Coal. Does the potential profit to be made from the products of coal flotation warrant the capital investment required for the necessary equipment? Supplies two theoretical cases to illustrate methods for computing such costs. ***James W. Miller.*** *Mining Engineering*, v. 13, Mar. 1961, p. 269-271.

* **The Influence of Hydrolysis Products of Tri-*n*-Butylophosphate on Uranyl Nitrate Extraction Process by 40 Per Cent TBP Kerosene Solution.** (*In Polish.*) Wpływ produktów hydrolizy fosforanu trōj-*n*-butylowego (TBP) na proces ekstrakcji azotanu uranylu 40-procentowym TBP w mepazynie. ***Czesław Deptuła and Wincenty Korpak.*** *Nukleonika*, v. 6, no. 1, 1961, p. 49-56.

Recovering Tin From Hardhead by Selective Oxidation of Iron. Promising systems for selectively oxidizing the iron in an iron-tin alloy were investigated in a research project conducted to devise a method for recovering tin from this troublesome alloy. A satisfactory oxidation method was developed and tested successfully. ***D. A. Wilson and P. M. Sullivan.*** *U. S. Bureau of Mines Report of Investigations* 5756, 1961, 17 pp.

Di-2-amyl 2-Butylphosphonate as an Extractant for the Recovery of Uranium and Plutonium. A good preparative method was developed for the synthesis of di-sec-alkyl sec-alkylphosphonates. Di-2-amyl 2-butylphosphonate (DABP) was chosen for potential application in the Purex process. ***Thomas H. Siddall, III.*** *U. S. Atomic Energy Commission, DP-548*, Feb. 1961, 16 pp. (UF767 Un3.1dp Contin.)

Pre-Reduced Iron-Ore Pellets, Their Experimental Preparation. A super blast-furnace feed—hard prereduced pellets—has been the objective of small-scale experimental work. Results justify further research. ***J. P. Hansen, N. B. Melcher, and M. M. Fine.*** *Journal of Metals*, v. 13, Apr. 1961, p. 314-315.

* **Some Reasons for Selectivity in Copper Activation of Minerals.** In zinc flotation, the great value of $CuSO_4$ results from its ability to activate ZnS preferentially to gangue minerals. ***C. H. G. Bushell, C. J. Krauss, and G. Brown.*** *Canadian Mining and Metallurgical Bulletin*, v. 54, no. 587, Mar. 1961, p. 244-251.

* **The Dry Concentration of Ores and Minerals.** ***R. A. Kipp.*** *Canadian Mining and Metallurgical Bulletin*, v. 54, no. 587, Mar. 1961, p. 241-243.

PHYSICS

Interaction of an Electron Beam With a Fully Ionized Plasma. Preliminary experiments using an almost fully ionized thermal cesium plasma have been carried out with encouraging results. ***M. A. Allen and G. S. Kino.*** *Physical Review Letters*, v. 6, no. 4, Feb. 15, 1961, p. 163-165.

An Ion Source for Molecular Effusion Studies. A source which utilizes a beam of monoenergetic electrons as the ionizing agent was designed and built for use in a 60° sector general utility mass spectrometer. The source was made to be used without a magnetic field to collimate the electron beam. ***Don Merrill Jackson and D. E. Hudson.*** *U. S. Atomic Energy Commission, ISC-1175*, May 1959, 82 pp. (UF767 Un3.1is Contin.)

Wave Zone in General Relativity. The above is defined for systems which are asymptotically flat. In this region, gravitational radiation propagates freely, independent of its interior sources, and obeys the superposition principle. ***R. Arnowitt, S. Deser, and C. W. Misner.*** *Physical Review*, v. 121, 2nd ser., no. 5, Mar. 1, 1961, p. 1556-1566.

Infrared Lattice Bands of Quartz. ***W. G. Spitzer and D. A. Kleinman.*** *Physical Review*, v. 121, 2nd ser., no. 5, Mar. 1, 1961, p. 1324-1335.

Cryogenic Magnets. A niobium-tin selenoid is superconductive in a field of 88,000 gauss. *Electromechanical Design*, v. 5, no. 3, Mar. 1961, p. 48-49.

* **Rayleigh's Problem in Magnetohydrodynamics for a Non-Perfect Conductor.** The governing equations for the fluid velocity and the electromagnetic quantities are obtained, and the Laplace transform of their solution found. ***D. G. Drake.*** *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods*, v. 8, nos. 5-6, 1960, p. 467-477.

* **The Electromagnetic Fields of a Dipole in the Presence of a Thin Plasma Sheet.** Dependence of the radiation pattern and the surface wave characteristics on elecrton density, collision frequency and the impressed magnetic field is illustrated. ***James R. Wait.*** *Applied Scientific Research, Sec. B, Electrophysics, Acoustics, Optics, Mathematical Methods*, v. 8, nos. 5-6, 1960, p. 397-417.

* **Investigation of the Hot Expansion of GaAs and ZnSe.** (*In Russian.*) Issledovanie teplovogo rasshireniia GaAs i ZnSe. ***S. I. Novikova.*** *Fizika Tverdogo Tela*, v. 3, no. 1, Jan. 1961, p. 178-179.

* **Diffusion of Beryllium in Germanium.** The coefficient of diffusion D and the solubility of Be in Ge c_o between 720 and 920 C were determined. D was found to equal $0.5 \exp(-\frac{2.5}{kT})$, c_o in the interval indicated slight dependence upon the temperature. (*In Russian.*) Diffuziia berilliia v germanīi. ***Iu. I. Beliaev and V. A. Zhidkov.*** *Fizika Tverdogo Tela*, v. 3, no. 1, Jan. 1961, p. 182-184.

* **The Faraday Effect on Free Carriers in Bi_2Te_3 in a Weak Magnetic Field.** The tensor of the specific inductive capacitance of Bi_2Te_3 in the field oriented in an arbitrary way was calculated. Formulas were obtained for the rotation of the plane of polarization and for the degree of ellipticity of the previous radiation along the optical axis in the microwave and infrared regions, when the direction of the magnetic field coincides with the optical axis. (*In Russian.*) Effekt Faradeia na svobodnykh nositeliakh v Bi_2Te_3 v slabom magnitnom pole. ***F. G. Baksht.*** *Fizika Tverdogo Tela*, v. 3, no. 1, Jan. 1961, p. 243-251.

Parity. Attempts to provide a nonmathematical account of the importance of conservation laws in elementary-particle physics and the way in which this hypothesis was built into

our thinking in this field. The steps by which it was first called into question in the case of certain weak interactions are outlined, and a brief account is given of the beautiful experiments which demonstrated that the concept was not universally valid. ***Graham P. McCauley.*** *American Journal of Physics,* v. 29, no. 3, Mar. 1961, p. 173-181.

* **A Unified Nonlinear Theory of Elementary Particles.** Studies the convergence problem of the "new Tamm-Dancoff method" and presents an approximation method for the solution of the convariant equation of the propagator neglecting the four-point- and higher correlations. (*In German.*) Zur nichtlinearen Spinortheorie der Elementarteilchen. ***K. Ladányi.*** *Zeitschrift für Naturforschung,* v. 16a, Jan. 1961, p. 79-91.

* **On the Theory of Electric Conductivity of Semiconductors in Magnetic Field.** A quantum theory of the transverse conductivity of semiconductors in a strong magnetic field is developed by taking into account inelastic scattering of electrons. (*In Russian.*) K teorii elektroprovodnosti poluprovodnikov v magnitnom pole. I. ***V. L. Gurevich and Iu. A. Firsov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 40, no. 1, Jan. 1961, p. 199-213.

* **On Conservation Laws in the General Theory of Relativity.** For determination of the integral of a vector function in Riemannian geometry and of a vector field corresponding to a displacement of the origin of coordinates, a geometric operation of "harmonic" translation of the vector is introduced which is defined in a unique manner by aid of first order general covariant differential linear equations. (*In Russian.*) O zakonakh sokhraneniia v obshcheĭ teorii otnositel'nosti. ***M. E. Gertsenshteĭn.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 40, no. 1, Jan. 1961, p. 114-122.

A Sketch for a History of the Kinetic Theory of Gases. ***E. Mendoza.*** *Physics Today,* v. 14, Mar. 1961, p. 36-39.

Hydromagnetic Stability of a Tubular Pinch. Necessary and sufficient conditions are derived for pinch stability with a very thin current layer. ***William A. Newcomb and Allan N. Kaufman.*** *Physics of Fluids,* v. 4, no. 3, Mar. 1961, p. 314-334.

Some Notes on Theories of Helium. Points out that approximation of the quantum mechanical partition function for an imperfect fluid is afforded by assuming the commutation of the kinetic and potential energy operators. ***F. J. Pearson.*** *Physical Society, Proceedings,* v. 77, pt. 2, Feb. 1961, p. 531-549.

* **Investigation of the Fine Structure of the X-Ray Absorption K-Edges for Manganese in MnTe Within the Range of Antiferromagnetic Transformation Temperatures.** (*In Russian.*) Issledovanie tonkoĭ struktury rentgenovskikh K-kraev pogloshcheniia margantsa v MnTe v oblasti temperatur antiferromagnitnogo prevrascheniia. ***E. E. Vainshteĭn, B. I. Kotliar, and R. M. Ovrutskaia.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 1, Jan.-Feb. 1961, p. 133-135.

* **On the Theory of Discrete Space-Time.** (*In Russian.*) K teorii diskretnogo prostranstva-vremeni. ***V. G. Karyshevskiĭ.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 1, Jan.-Feb. 1961, p. 70-73.

* **On the Theory of Mossbauer's Effect.** (*In Russian.*) K teorii effekta Mossbauera. ***I. P. Dziub and A. F. Lubchenko.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 1, Jan.-Feb. 1961, p. 66-69.

Preliminary Operational Safety Report for the Task 5.6 Thermoelectric Generator. This preliminary report evaluates the operational hazards associated with the use of a Pu-fueled thermoelectric generator in a terrestrial satellite. A final report will refine and resolve the areas of uncertainty, based upon specific vehicle characteristics, detailed aerodynamic calculations, and safety test data. ***Daniel Knighton.*** *U. S. Atomic Energy Commission, MND-*P-2356, May 1960, 51 pp. (UF767 Un3.1mn Contin.)

The International Encyclopedia of Physical Chemistry and Chemical Physics. Topic 6. The Kinetic Theory of Gases. Elements of the Kinetic Theory of Gases. Particular importance has been given to the exposition of the fundamental

bases of each topic and to the development of the theoretical aspects; experimental details of an essentially practical nature are not emphasized although the theoretical background of techniques and procedures is fully developed. ***E. A. Guggenheim, editor.*** v. 1. 92 pp. 1960. Pergamon Press, New York. (QC175 G93e)

Cambridge Monographs on Physics. X-Ray Microscopy. Technique is used for microscopic examination of plant and animal tissues, and also of living organisms. In metallurgy and mineralogy, it is used for nondestructive microanalysis, for detecting segregations and inclusions in metals and alloys and for inspecting welds and castings. It has also been applied to paper, fibers and fabrics. ***V. E. Cosslett and W. C. Nixon.*** 406 pp. 1960. Cambridge University Press, London. (QC373.X2 C82x)

Optics of the Electromagnetic Spectrum. A guide to general methods for solving problems of wave optics in anticipation of new developments throughout the spectrum. Treats the properties of wave motion common to the whole electromagnetic spectrum. Treatment of the optics of the whole spectrum is simpler and far more revealing than any of a series of studies of X-rays, visible light, or microwave topics. ***C. L. Andrews.*** 501 pp. 1960. Prentice-Hall, Inc., Englewood Cliffs, New Jersey. (QC673 An260)

The Detection of Single Quanta of Circulation in Liquid Helium II. Apparatus is described. ***W. F. Vinen.*** *Royal Society, Proceedings,* v. 260, ser. A, Feb. 21, 1961, p. 218-236 + 1 plate.

Applications of Flexible Magnets. ***A. R. Gardner.*** *Engineers' Digest,* v. 22, Feb. 1961, p. 82-83. (From *Product Engineering,* v. 32, no. 2, Jan. 9, 1961, p. 65-68.)

* **The Parameters γ and ϕ for Equi-Inclination, With Application to the Single-Crystal Counter Diffractometer.** A program has been written for the IBM 704 digital computer which computes γ, ϕ, $1/Lp$ for equi-inclination, and sin θ for each reflection of any crystal system. ***Charles T. Prewitt.*** *Zeitschrift für Kristallographie,* v. 114, nos. 5-6, Dec. 1960, p. 355-360.

Melting and Freezing. The Fifth Charles Tennant Memorial Lecture. ***A. R. Ubbelohde.*** *Chemistry and Industry,* 1961, no. 7, Feb. 18, p. 186-191.

International Summer Course in Plasma Physics 1960. Consists of 37 papers presented at the Summer Course held at Risö in August, 1960. *Danish Atomic Energy Commission, Risö Report No.* 18, Nov. 1960, 645 pp.

Calibration of a Prism Spectrometer. A numerical method of interpolation and a program for a Bendix G15D digital computer for calibration of spectrometers is described. The method and program are of general applicability. ***W. G. Henry and M. R. Meharry.*** *Optical Society of America, Journal,* v. 51, Mar. 1961, p. 356-359.

* **Some Properties of the Cesium Plasma From a Thermoelectronic Converter.** (*In Russian.*) Nekotorye svoĭstva tsezievoĭ plazmy termoelektronnogo preobrazovatelia energii. ***N. D. Morgulis and Iu. P. Korchevoi.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 2, Jan. 11, 1961, p. 336-338.

Electrical Resistivity of Liquid Sodium, Liquid Lithium, and Dilute Liquid Sodium Solutions. The three factors of atomic size, ion-core potential, and charge, which contribute to the increment in electrical resistivity produced by solutes in metallic solutions, were separated and experimentally evaluated in liquid sodium. ***J. F. Freedman and W. D. Robertson.*** *Journal of Chemical Physics,* v. 34, Mar. 1961, p. 769-780.

* **Change of Resistivity of Some Metals to 200,000 kG/cm².** (*In Russian.*) Izmenenie elektricheskogo soprotivleniia nekotorykh metallov do davleniia 200,000 kG/cm². ***L. F. Vereshchagin, A. A. Semerchan, N. N. Kuzin, and S. V. Popova.*** *Akademiia Nauk SSSR, Doklady,* v. 136, no. 2, Jan. 11, 1961, p. 320-321.

Proceedings of the Sixth Symposium on Magnetism and Magnetic Materials. Contains some 150 symposium papers divided into 15 somewhat arbitrary sections including com-

puter devices, metallic films, nuclear hyperfine fields, ferromagnetic resonance, magnetization processes and fine particles, microwave devices, and metals and alloys. ***J. H. Crawford, Jr., editor.*** *Journal of Applied Physics* (Supplement), v. 32, Mar. 1961, 399 pp.

PLASTICS

* **Infrared Analysis and Epoxy Formulation.** Spectrophotometer described may be used with epoxies and should also be of value to the formulator of vinyls, copolymers, and compounds containing nitrile groups. ***Henry L. Lee.*** *Plastics Technology*, v. 7, Feb. 1961, p. 47-49.

* **A Contribution to the Study of the Graft Copolymers Radiochemically Prepared. I. General Conditions of the Grafting Process. Separation and Characterization of the Graft Copolymer. II. Kineties of Formation of the Graft Copolymer and of the Homopolymer.** (*In French.*) Contribution a l'étude des copolymères greffés préparés par voie radiochimique. I. Conditions générales du greffage. Séparation et caractérisation du copolymère greffé. II. Cinétique de formation du copolymère greffé et de l'homopolymère. ***Jeanne Sebban-Danon.*** *Journal de Chimie Physique*, v. 58, Feb. 1961, p. 246-276.

* **Interpolymerization of Acrylonitrile and Vinylidene Chloride in *tert*-Butyl Alcohol.** True interpolymers of acrylonitrile and vinylidene chloride were prepared with the use of *tert*-butyl alcohol or a mixture of *tert*-butyl alcohol and water as the polymerization solvent. ***E. H. Hill and J. R. Caldwell.*** *Journal of Polymer Science*, v. 47, Nov. 1960, p. 397-402.

* **Safflower Oil Adducts as Plasticizers.** Eleven esters and epoxides of adducts of conjugated linoleic acid with maleic and acrylic acids, and eight esters and epoxides of adducts of vegetable oils with acrylic and maleic esters were evaluated as plasticizers for polyvinyl chloride (PVC), acrylonitrile rubber, and polyvinylidene chloride, and in PVC plastisols. The dimethyl ester of the acrylic adduct of linoleic acid and its epoxide were the most promising as plasticizers for PVC and in PVC plastisols as their performance compared favorably with that of controls. In polyvinylidene chloride, however, these adducts had a slight adverse effect on color stability. The vegetable oil adduct esters and epoxides were incompatible with PVC but had extremely good compatibility with acrylonitrile rubber. In general, they performed like the petroleum type of plasticizers but were less volatile and less easily extractable. ***H. M. Teeter, J. C. Cowan, L. E. Gast, W. J. Yurgen, and R. A. Clark*** *American Oil Chemists' Society, Journal*, v. 38, Mar. 1961, p. 117-120.

* **Silane Derivatives With Hydrocarbon Bridges Between Silicon Atoms On the Polymerization of 1,1-Dimethylsilicacyclopentane.** (*In Russian.*) Proizvodnye silanov s uglevodorodnymi mostikami mezhdu atomami kremniia. O polimerizatsii 1,1-dimetilsilikatsiklopentana. ***V. M. Vdovin, et al.*** *Akademiia Nauk SSSR, Doklady*, v. 136, no. 1, Jan.-Feb. 1961, p. 96-99.

* **Metal Ketyls as Initiators of Polymerisation of Vinyl Monomers. Polymerisation of Acrylonitrile, Styrene and Methyl Methacrylate by Disodium Benzophenone.** Anionic polymerization of acrylonitrile, styrene and methyl methacrylate by disodium benzophenone in tetrahydrofuran, effects of concentration of catalyst and monomer and the mechanism of the polymerization are discussed. ***Albert Zilkha, Pedatsur Neta, and Max Frankel.*** *Research Council of Israel, Bulletin*, v. 9A, nos. 3-4, Nov. 1960, p. 185-192.

* **Diffusion and Permeation of Gases in High Polymers as a Function of the Degree of Crystallization and of Temperature.** The Barrer method was used in determining the coefficients of permeation, diffusion and solubility of permanent gases in teryls and propyls. The three values are considerably lowered in the crystallized substances as compared with the corresponding amorphous substances. The decrease of the coefficients due to the crystallization of polymers is a function of the type of gas and of temperature. Thus the partly crystalline polymer for the diffusion and sorption of the gases behave as a two-phase system with a permeable (amorphous) and an impermeable (crystalline) phase. (*In German.*) Diffusion und Permeation von Gasen in Hochpolymeren in Abhängigkeit vom Kritallisationsgrad und von der Temperatur. ***D. Jeschke and H. A. Stuart.*** *Zeitschrift für Naturforschung*, v. 16a, Jan. 1961, p. 37-50.

Butadiene-Styrene Copolymer Latices for Coated Printing Papers and Boards. Butadiene copolymer latex manufactured by I.C.I. Plastics Division, used to advantage in conventional on- and off-machine coated printing papers and boards. *Plastics* (*London*), v. 26, Mar. 1961, p. 113-116.

* **A New Polyester Dielectric for Capacitors.** Poly(1,4-cyclohexylenedimethylene terephthalate) forms the basis of the new linear polyester film which is referred to as T16 film. T16 has a stable dielectric constant, low dielectric loss, high dielectric strength, and high volume resistivity. In addition, it has outstanding resistance to the deleterious effects of water vapor, solvents, and alkalis. ***Richard G. Devaney.*** *Insulation*, v. 7, Apr. 1961, p. 36-40.

* **Byproducts of the Synthesis of 2-Methyl-5-vinylpyridine. II. Origin of the "Popcorn" Insoluble Polymer of 2-Methyl-5-vinylpyridine.** Formation of popcorn polymer is often observed during various stages of the manufacture of 2-methyl-5-vinylpyridine (obtained via 2-methyl-5-ethylpyridine dehydrogenation). The agent for this polymerization is identified as 2,5-divinylpyridine. Method adopted for the determination of the popcorn-generating activity is reported. (*In Italian.*) Sottoprodotti della sintesi della 2-metil-5-vinilpiridina. II. Origine della formazione del polimero insolubile (popcorn) della 2-metil-5-vinilpiridina. ***A. Nenz and G. B. Gechele.*** *Chimica e l'Industria*, v. 43, Feb. 1961, p. 142-146.

Infra-red Spectrum of Polyethylene. Infrared spectrophotometry was used to study crystallinity, branching, and oxidation process. ***D. L. Wood and J. P. Luongo.*** *Modern Plastics*, v. 38, no. 7, Mar. 1961, p. 132 + 13 pages.

* **Time-Temperature Dependence of Strength of Polymer Fibers. I.** The time-temperature dependence of the tensile strength of viscose, capron, polyproplyene, nitrile and chlorovinyl fibers has been investigated over the temperature range 150-120 C. The fiber life τ decreases exponentially with increase in stretching stress σ and absolute temperature T. The constants τ_o, u_o, and γ, which determine the strength of the fiber, have been calculated. The coefficient u_o determining the activation energy of the breakdown of the polymer fibers corresponds to chemical bond energy. The factor γ of the dimensions of volume was found to be highly susceptible to changes in the structure of the fibers. An activation mechanism of polymer rupture has been suggested. This is conceived of as a process developing in time under the action of temperature and mechanical stress. (*In Russian.*) Temperaturnaia i vremennaia zavisimost' prochnosti polimernykh volokon. ***S. N. Zhurkov and S. A. Abasov.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 3, Mar. 1961, p. 441-449.

* **A New Method to Characterize the Structure of Polyacrylonitrile Fiber.** A method to characterize the structure of hard polymers (powders, grain, fiber, film) by the rate of heat liberation (Q cal/g) during 1 to 5 minutes during their treatment with a solvent was suggested. The rate of heat liberation during the swelling of polyacrylonitrile and polyvinyl chloride is rarely decreased during the formation of the fiber in the stretching and drying process and also during the drying or exposure to light of the initial polymer. It can change between 10 to 30 times. (*In Russian.*) Novyĭ metod kharakteristiki struktury poliakrilonitril'nogo volokna. ***A. B. Pakshver and T. M. Kazbekova.*** *Khimicheskie Volokna*, 1961, no. 1, p. 22-24.

* **Effect of the Grafting of Polystyrene on Some Properties of Oriented Polyethylene.** When styrene is grafted onto oriented polyethylene the birefringence is found to be greater than that of the initial oriented specimen. It has been suggested that the grafting takes place in the submicro voids formed during the cold drawing of the polyethylene. The birefringence is hence of a rod source. For a grafted polystyrene content exceeding 7% violation of the chain orientation in the polyethylene takes place owing to a filling-in of all the submicro voids by the grafted polymer, affecting the dependence of

Δn on the amount of the grafted polystyrene. The assumptions made regarding the site of grafting of polystyrene and the growth of the polystyrene regions have been verified by investigations on the relation between the length of the grafted specimens and the temperature and by calculations from these data of the activation energies of the processes taking place during contraction of the polymers. (*In Russian.*) Vliianie privivki polistirola na nekotorye svoĭstva orientirovannogo polietilena. ***T. E. Lipatova, Iu. S. Lipatov, and N. L. Tutaeva.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 2, Feb. 1961, p. 184-190.

* **The Action of Fast Electrons on the Structure of Polystyrene.** Irradiation impairs the regularity of the isotactic polystyrene chain, leading to amorphism of the polymer. Double bonds of the type $R_2C = CHR$ and $RCH = CHR$ (*cis*) are formed in polystyrene during the irradiation process. Hydrogen liberated during the rupture of the CH bond in the backbone of one molecule of the polymer hydrogenizes the phenyl ring of a neighboring molecule with the formation of a cyclodiene ring with double bonds of the above type and crosslinkage between the molecules. In the polystyrene backbone conjugated double bond systems of the type $R_2C = CH - CR = CH - R$ are formed. (*In Russian.*) Deĭstvie bystrykh elektronov na strukturu polistirola. ***N. A. Slovkhotova, Z. F. Ucheva, and V. A. Kargin.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 2, Feb. 1961, p. 191-197.

* **Polymerization of N-Substituted Methacrylamides. III. N, N-Disubstituted Methacrylamides.** A number of N,N-disubstituted methacrylamides have been synthesized, of which methyl-*o*-, *p*- and *m*-ethoxyphenylmethacrylamides have been synthesized and characterized for the first time. It has been shown that N,N-disubstituted methacrylamides do not polymerize under conditions of radical polymerization. Dimethyl-, diethyl-, diphenyl-, methylphenyl- and piperidylmethacrylamides form viscous liquids on irradiation by ultraviolet light in the presence of BF_3. Some of the compounds synthesized copolymerize with methylmethacrylate and styrene. It has been proposed that the absence of ability for radical polymerization among N,N-disubstituted methacrylamides is due to steric hindrances. (*In Russian.*) Polimerizatsiia N-zameshchennykh metakrilamidov. III. N,N-dizameshchennye metakrilamidy. ***T. A. Sokolova and G. M. Chetvrkina.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 2, Feb. 1961, p. 244-247.

* **Polymers With a Conjugated Bond System and Heteroatoms in the Conjugate Chain. XII. The Synthesis and Properties of Some Polyaminoquinones.** Polyaminoquinones were synthesized by the interaction of *p*-benzoquinone with hexamethylenediamine, *p*-phenylenediamine, benzidine and benzidine-3,3'-dicarboxylic acid. The resultant compounds are nonfusible, possess electron-exchange properties and give intense electron resonance signals. The polymers obtained from aromatic diamines are thermostable. The polymer prepared with benzidine dicarboxylic acid was characterized by somewhat enhanced electroconductivity. On interaction with copper salts in solution it yields an insoluble salt, presumably of the type of crosslinked chelate polymers. (*In Russian.*) Polimery s sistemoĭ sopriazhennykh sviazeĭ i geteroatomami v tsepi sopriazheniia. XII. Poluchenie i svoĭstva nekotorykh poliaminokhinonov. ***V. P. Parini, Z. S. Kazakova, M. N. Okorokova, and A. A. Berlin.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 3, Mar. 1961, p. 402-407.

* **Laevoglucosan Polyethers. I. Polymerization of Laevoglucosan and Its Ethers.** Polymerization of laevoglucosan and of its ethers, leading to high molecular weight polymers has been described. The most efficient catalysts for the reaction were shown to be boron fluoride etherates, ferric choride and aluminum chloride. Owing to the presence of free secondary hydroxyl groups chain transfer reactions take place to a considerable extent during the process, leading to the formation of amorphous and evidently branched polymers. In the case of polymerization of trimethyllaevoglucosan the resultant polymer is crystalline and evidently of linear structure. Polymerization of laevoglucosan with the formation of polymers of molecular weight 20,000-60,000 is carried out at 90-100° in absolute dioxane. Polymerization of trimethyllaevoglucosan leading to polymers of molecular weight 250,000-400,000 is carried out at 20° in absolute toluene. A mechanism has been proposed for the polymerization of trimethylglucosan and a discussion presented of the polymerization mechanism of laevoglucosan. (*In Russian.*) Poliefiry levogliukozana. I. Polimerizatsiia levogliukozana i ego efirov. ***V. V. Korshak, O. P. Golova, V. A. Sergeev, N. M. Merlis, and R. Ia. Shneer.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 3, Mar. 1961, p. 477-485 + 1 plate.

* **A Study of Polymer Film Brittleness.** By both conventional and novel testing techniques, stress-time-temperature relationships were studied to determine the brittle point. From high-speed tensile tests at strain rates up to 10%/min., the critical strain rate was determined for representative films. ***L. E. Amborski and T. D. Mecca.*** *Journal of Applied Polymer Science*, v. 4, no. 12, Nov.-Dec., 1960, p. 332-342.

Properties and Structure of Polymers. Provides a description and an explanation of the mechanical behavior of polymers in terms of the fundamental principles of molecular structure and dynamics. ***Arthur V. Tobolsky.*** 331 pp. 1960. John Wiley, New York. (QD471 T55p)

POLLUTION AND WASTES

* **Algae as a Source of Oxygen in Waste Treatment.** ***A. F. Bartsch.*** *Water Pollution Control Federation, Journal*, v. 33, Mar. 1961, p. 239-249.

* **BOD Removal and Sludge Growth in the Activated Sludge Process.** ***Joseph McCabe and W. Wesley Eckenfelder, Jr.*** *Water Pollution Control Federation, Journal*, v. 33, Mar. 1961, p. 258-271.

* **New Developments in Dairy Waste Treatment.** ***C. W. Watson, Jr.*** *Industrial Water & Wastes*, v. 6, no. 2, Mar.-Apr. 1961, p. 55-59.

* **Effect of Preaeration on the Primary Treatment of Sewage.** An average improvement of seven to eight percentage points in both primary BOD and suspended solids removals following preaeration. ***Harris F. Seidel and E. Robert Baumann.*** *Water Pollution Control Federation, Journal*, v. 33, Apr. 1961, p. 339-355.

Hydrocarbon Emissions From Automobiles. Exhaust and crankcase emission data indicate that the former accounts for approximately 70% and the latter for approximately 24% of the total emissions, based on a numerical average of the results obtained with five cars. ***Paul R. Lepisto, Herbert C. McKee, Kenneth D. Mills, and Ralph J. Wheeler.*** *Air Pollution Foundation, Report No.* 32, Feb. 1961, 45 pp. (TD884 Ai71.3r Vis.)

A Progress Report on the Photochemistry of Polluted Atmospheres. Medium to severe eye irritation was obtained with photo-oxidation of mixtures containing 0.5 ppm each of certain olefins and nitrogen dioxide. These concentrations are comparable with those existing in the Los Angeles atmosphere. These irritation levels can be largely accounted for by the presence of two irritants, formaldehyde and compound X; most probable structure is that of a peroxyacylnitrate, formed during photo-oxidation. The only other eye irritant found to date is acrolein, which is a major product of the photo-oxidation of 1,3-butadiene. ***E. A. Schuck, George J. Doyle, and Noboru Endow.*** *Air Pollution Foundation, Report No.* 31, Dec. 1960, 79 pp. (TD884 Ai71.3r Vis.)

* **Research on Control of Emissions From Bessemer Converters.** Data were taken from a laboratory-scale Bessemer converter to determine reactions involved in the formation of waste gases and solids during operation of the converter, and the composition of these emission products. ***Alexander R. Orban, John D. Hummell, and George G. Cocks.*** *Air Pollution Control Association, Journal*, v. 11, no. 3, Mar. 1961, p. 103-113.

* **Removal of Sewage Nutrients by Algae.** ***R. H. Bogan.*** *Public Health Reports*, v. 76, Apr. 1961, p. 301-308.

* **Exhaust Composition in Relation to Fuel Composition.** ***Robert E. Neligan, Paul P. Mader, and Leslie A. Chambers.*** *Air Pollution Control Association, Journal*, v. 11, no. 4, Apr. 1961, p. 178-186.

RELIABILITY ENGINEERING

* **Multi-Component Systems and Structures and Their Reliability.** Deals with general classes of systems which contain two-terminal networks and most other kinds of systems considered previously as special cases, and investigates their combinatorial properties and their reliability. ***Z. W. Birnbaum, J. D. Esary, and S. C. Saunders.*** *Technometrics*, v. 3, no. 1, Feb. 1961, p. 55-77.

* **Reliability of Electro-Magnetic Delay Lines.** ***Earl C. Rau.*** *Military Systems Design*, v. 5, no. 1, Jan.-Feb. 1961, p. 8-10.

Improving Electronic Reliability. Points out the pitfalls which may be encountered and makes specific recommendations to avoid them, so that total potential reliability may be realized in the final equipment. ***Morris Halio.*** *IRE Transactions on Military Electronics*, v. MIL-5, no. 1, Jan. 1961, p. 11-18. (TK1 In6.6mi Vis.)

* **Maximizing Electronic Reliability.** ***Morris Halio.*** *British Institution of Radio Engineers, Journal*, v. 21, Feb. 1961, p. 121-128.

* **Robustness of Life Testing Procedures.** How valid is assumed exponential distribution? Life testing; acceptance sampling; failure causes; types of life tests; robustness; small samples. ***Mary C. Dannemiller and M. Zelen.*** *Missile Design & Development*, Mar. 1961, p. 35 + 2 pages.

* **Personnel Training.** For high reliability manufacturing. ***Sidney R. Cohen.*** *Missile Design & Development*, Mar. 1961, p. 62 + 2 pages.

Repeaters for Transatlantic Cables: Passive Components. Two transatlantic cables were assured by a meticulous reliability program, of the longest possible trouble-free life. ***A. H. Schafer.*** *Bell Laboratories Record*, v. 39, Mar. 1961, p. 103-106.

How Environment Affects Ocean Cables. Relies on a program in which it can evaluate the effects of undersea environments from samples of cables brought ashore from repair operations. ***Peggy M. Hazard.*** *Bell Laboratories Record*, v. 39, Mar. 1961, p. 92-96.

Measuring Semiconductor Lifetime. The time scale of transient effects in semiconductors reflects the presence of crystal defects. By measuring this "lifetime" one can determine the properties of such impurities and imperfections introduced to give the semiconductor desired characteristics. ***G. K. Wertheim.*** *Bell Laboratories Record*, v. 39, Mar. 1961, p. 87-91.

* **The Growing Problem of Reliability.** Concludes that while a good percentage of the success of a sound program depends on the design engineer, reliability is everyone's business. *American Machinist*, v. 105, Apr. 17, 1961, p. 122-123.

RUBBER AND ELASTOMERS

* **High Speed Stress Relaxation.** Newly developed techniques aid in determining dynamic properties of elastomers. ***R. M. Cardillo, W. W. Gleason, R. D. Andrews, and F. J. McGarry.*** *Rubber Age*, v. 88, no. 6, Mar. 1961, p. 973-980.

* **Polymers From Gelatin & Oxyacids of Vanadium, Molybdenum & Tungsten.** Polyacids of V, Mo, and W form rubber-like polymers with gelatin in the ph range 1.4 to 4.3 Infrared absorption spectra of the polyacids show the characteristic bands due to inorganic polyacids, in addition to those due to gelatin. X-ray studies on stretched samples reveal the amorphous nature of the polymers. ***S. Kumar and B. C. Sinha.*** *Journal of Scientific & Industrial Research*, v. 20B, Jan. 1961, p. 38-39.

* **Vulcanization of Chlorinated Ethylene-Propylene Copolymers.** Chlorinated ethylene-propylene copolymers can be vulcanized with the conventional sulfur recipes, because, during the heat treatment of the vulcanization, a partial dehydrochlorination of the copolymer takes place and insaturations are introduced in the chains. Stabilization of the chlorinated copolymers in order to improve their aging resistance is also examined, and some results obtained in the bromination of the ethylene-propylene copolymers are reported. (*In Italian.*) La vulcanizzazione dei copolimeri etilene-propilene clorurati. ***G. Crespi and M. Buzzone.*** *Chimica e l'Industria*, v. 43, Feb. 1961, p. 137-142.

Urethane Elastomers: New Material for Plastics Processors. Refined formulations, processable on plastics molding equipment, pave the way for penetration of markets formerly pre-empted by rubber industry. *Modern Plastics*, v. 38, no. 7, Mar. 1961, p. 88 + 4 pages.

* **Investigation of the Vulcanization of Polychloroprene Latexes. II. Sulfonation.** The interaction of polychloroprene latexes with alkaline metal polysulfides (sulfonation) has been studied at room and elevated temperatures. It has been found that the polymer reacts both with polysulfide itself as well as with alkaline metal thiosulfate accompanying the latter. In the first case the polymer is structurized by chains consisting of five sulfur atoms, in the second the Bunte polymer salt is formed. (*In Russian.*) Issledovanie vulkanizatsii polikhloroprenovykh lateksov. II. Sul'fidirovanie. ***D. M. Sandomirskii and E. M. Spektor.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 2, Feb. 1961, p. 255-261.

* **Mechanism of the Catalytic Polymerization of Cyclic Dimethylpolysiloxanes. IV.** The well-known oxidation-reduction system: $2KMnO_4 + 3H_2SO_4 = 2MnSO_4 + K_2SO_4 + 3H_2O + 2.5O_2$ employed as catalyst caused the polymerization of cyclic dimethylpolysiloxanes, leading to the formation of a rubber-like polymer (siloxane rubber). (*In Russian.*) K voprosu o mekhanizme kataliticheskoĭ polimerizatsii dimetilpolisiloksanov tsiklicheskogo stroeniia. IV. ***V. N. Gruber and L. S. Mukhina.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 2, Feb. 1961, p. 174-176.

* **Tensile Testing of Elastomers at Ultra-High Strain Rates.** Tensile and compressive test apparatus that can be used for routine testing at speeds up to 100,000 in./min. and for specialized experimentation at speeds as high as 200,000 in./min. Description of stress-strain measurements that were made on cast polyurethan. ***J. W. Jones.*** *Journal of Applied Polymer Science*, v. 4, no. 12, Nov.-Dec. 1960, p. 284-290.

* **Strength, Deformative and Viscous Properties of Acrylonitrile Rubber Solutions in Toluene-Decalin Solvent at High Deformation Rates.** The effect of solvent (toluene)–nonsolvent (decalin) mixture on the structure and mechanical properties of concentrated acrylonitrile rubber SKN-18 solutions has been investigated. The investigation was carried out in the range of high deformation rates (36-1100 sec^{-1}) on an elastor-elaxometer by a constant deformation rate technique. It has been shown that on addition of decalin the degree of structuration of the solutions increases owing to intensification of the intermolecular interactions of the rubber. This leads to a growth in the ultimate high elastic deformation, structural strength and viscosity. For a 1:1 decalin–toluene ratio the above characteristics exhibit a maximum. Excess decaline above the 1:1 ratio lowers the value of the characteristics, which is explained by excess intermolecular links, leading to microcoagulation of the rubber. It has been found that the maximum high elastic deformation and structural strength values of the rubber determined at high deformation rates are sensitive indicators of structural changes of the systems. (*In Russian.*) Prochnostnye, deformatsionnye i viazkostnye svoĭstva rastvorov nitrilakril'nogo kauchuka v smesi toluol-dekalin pri povyshennykh skorostiakh deformatsii. ***T. I. Zatsepina and A. A. Trapeznikov.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 1, Jan. 1961, p. 113-121.

* **Phosphonitrilechloride Rubber PNC.** The aging mechanism of phosphonitrilechloride rubber has been discussed. The phenomenon was studied by a number of methods. It was found that the aging is due to two processes: crystallization of the PNC rubber and hydrolysis of the P-Cl bonds with the formation of P-O-P links; crosslinking and concurrent degradation thus taking place. In the IR spectra, a shift in the absorption bonds corresponding to the P = N bond toward the shorter wavelength region has been noted with increase in degree of polymerization (MW from 2.10^6 to 1.10^6). (*In Russian.*) Fosfonitrilkhloridnyĭ kauchuk. ***S. M. Zhivukhin, V. B. Tolstoguzov, and Iu. V. Meĭtin.*** *Vysokomolekuliarnye Soedineniia*, v. 3, no. 3, Mar. 1961, p. 414-419.

* **Studies of Latex Foams.** Latex foams prepared mechanically differ from pneumatic foams in possessing a small foaming ratio (ratio of foam volume of liquid phase). The main criterion of their stability is the time before beginning of draining of the foam and hence the time for the beginning of the separating out of the latex. The basic property of the latex, determining the stability of foams with small foaming ratios is the viscosity. Latex foams of small foaming ratios acquire marked structuro-mechanical properties on aging. (*In Russian.*) Issledovanie lateksnykh pen. ***D. M. Sandomirskiĭ and A. A. Korotkova.*** *Kolloidnyĭ Zhurnal*, v. 23, no. 1, Jan.-Feb. 1961, p. 95-99.

* **Silicone Rubber for Seals, O-Rings and Gaskets.** Silicone rubber can be used for seals, O-rings and gaskets wherever operating conditions require the following characteristics: Good retention of elastomeric properties and flexibility when exposed to temperatures of 500 F constantly and up to 600 F intermittently; flexibility without cracking when exposed to temperatures as low as minus 130 F; good compression set characteristics; no loss of resiliency or other properties when exposed to normally deteriorating effects of weather, sunlight, corrosive industrial atmospheres or oxidation of storage; no cracking or checking in ozone atmospheres; good dielectric properties which remain relatively unchanged over the minus 130 to plus 500 F temperature range; good immunity to water and humidity; and little effect on physical and electrical properties by a variety of chemicals, oils and fluids. ***Victor W. Wigotsky.*** *Design News*, v. 16, Apr. 24, 1961, p. 8-11.

* **On the Tension-Temperature-Coefficient of Natural Rubber.** ***A. Ciferri.*** *Makromolekulare Chemie*, v. 43, nos. 1-2, Mar. 1961, p. 152-155.

SOLID STATES

Semiconductor Devices in Electromechanical Engineering. I. *Electromechanical Design*, v. 5, no. 3, Mar. 1961, p. 67-74.

Introduction to Solids. Uses the crystallinity of solids as a framework for discussing their nature and properties concentrating on the structure, nature, and properties of inorganic crystalline solids. Considers how crystals form, how they grow, how they can be deformed elastically and plastically, how they interact with each other, and the different forms in which they can exist. ***Leonid V. Azároff.*** McGraw-Hill, New York. (QD905 Az16i)

Elements of Maser Theory. First surveys the basic phenomena responsible for maser behavior with a brief description of the Bohr quantum theory and of statistical mechanics, then covers as much of the theory of quantum mechanics, statistical mechanics, and radiation theory as will be found helpful. Part three presents a reasonably complete theoretical treatment of the most basic and currently well-understood features of the subject. ***Arthur A. Vuylsteke.*** 362 pp. 1960. D. Van Nostrand Co., Inc., New York. (QC483 V98e)

* **The Change-of-State Crystal Oven.** A new oven which depends for its action upon the natural stability of the melting point of a pure crystalline material and upon the thermal ballasting which the property of latent heat of fusion provides. ***D. J. Fewings.*** *British Institution of Radio Engineers, Journal*, v. 21, Feb. 1961, p. 137-142.

Logic Combines Tunnel Diodes With Transistors. Switching speed of tunnel diodes and isolation capabilities of transistors are combined to obtain logic having switching times of 0.7 nanosecond. ***R. W. Lade.*** *Electronics*, v. 34, no. 9, Mar. 3, 1961, p. 46-47.

X-Ray Determination of Crystal Structures. Deals with the principles underlying X-ray diffraction, discussing the relation between the structure and the diffraction patterns, and how the one can be derived from the other. ***P. B. Braun and A. J. van Bommel.*** *Philips Technical Review*, v. 22, no. 4, 1960/61, p. 126-138.

* **Spectral Response of Solar-Cell Structures.** Measures the spectral response of silicon solar-cell structures, and observes how the response varied with the depth of the *p-n* junction. ***L. M. Terman.*** *Solid State Electronics*, v. 2, no. 1, Jan. 1961, p. 1-7.

* **A Rapid and Accurate Method for Measuring the Thickness of Diffused Layers in Silicon and Germanium.** Makes use of the brittleness of Si and Ge. The Ge or Si slice is broken in a special manner producing a rather flat cleavage surface, in which any disturbing fracture line is more or less perpendicular to the very sharp, long edges. In this surface the exposed *p-n* junctions are marked as very thin lines by electrolytical or chemical methods. The distances between these lines are measured with a microscope. ***B. Jansen.*** *Solid State Electronics*, v. 2, no. 1, Jan. 1961, p. 14-17 + 2 plates.

SPACE HEATING AND CONDITIONING

Heat Transfer Through Mineral Wool Insulation in Combination With Reflective Surfaces. Answers the questions:—How accurate are conventional calculations of heat gains and losses through insulated frame structures? How effective are reflective materials when used with mineral wool insulation under different conditons of heat transfer? ***C. E. Lund and R. M. Lander.*** *ASHRAE Journal*, v. 3, Mar. 1961, p. 47 + 11 pages.

Control of Odor and Irritation Due to Cigarette Smoking Aboard Aircraft. In this study the authors quantitatively predict the probable contamination rate and investigate subjective reactions to various contamination levels. Workable approaches to meeting the demanding requirements of tomorrow's aircraft are discussed. ***P. F. Halfpenny and P. S. Starrett.*** *ASHRAE Journal*, v. 3, Mar. 1961, p. 39-44.

* **Acoustical Design of Ventilating Systems. II.** Part I of this article published in the Sept. 1960 issue of the Journal dealt with the means of predicting noise characteristics of any acoustically untreated ventilation system. In Part II, the author discusses various methods of noise reduction as regards fans, ductwork, ventilated areas, and numerous other aspects of the problem. ***D. R. Johnson.*** *Institution of Heating and Ventilating Engineers*, v. 28, Feb. 1961, p. 389-400.

Will Public Utilities Sell District Heating *and* Cooling? In Hartford, Conn., an urban redevelopment project will be provided with public utility-owned steam and chilled water via 14,000 ft of underground pipeline. The potential market and the problems which occur are explained. *Heating, Piping & Air Conditioning*, v. 33, Mar. 1961, p. 97-99.

Build Air Conditioning Design on Principal Heat Gain Factor. Architects and mechanical engineers combined forces to insure that the Union Oil Co. of Calif. home office in Los Angeles, subject to high year-round temperatures and extreme sun load, would profit from an architectural and air-conditioning design which deals with these factors first. ***Lester Ries.*** *Heating, Piping & Air Conditioning*, v. 33, Mar. 1961, p. 110-114.

Five Views of Integrated Lighting-Air Conditioning. A recent conference in Chicago occasioned informed discussion on problems of coordinating improved lighting and air-conditioning techniques for the modern office structures of today. *Heating, Piping & Air Conditioning*, v. 33, Mar. 1961, p. 104-107.

* **Transistor Production in Nitrogen Atmosphere.** *Assembly & Fastener Engineering*, v. 4, Feb. 1961, p. 28-30.

* **Facts, Not Estimates.** Merits of electric heating influenced its selection in Bayless School District adjacent to St. Louis, Mo. *Electric Heat and Airconditioning*, v. 7, no. 2, Mar.-Apr. 1961, p. 17 + 3 pages.

* **From Pot-Bellied Stove.** 1874 House converts happily from partial heating to full-house electric heat. *Electric Heat and Airconditioning*, v. 7, no. 2, Mar.-Apr. 1961, p. 22-23.

* **Experimental Studies on the Sound Absorbing Characteristics of Acoustic Materials.** The results of the measurements of sound absorbing characteristics of panel absorbents, for example, plywood, asbesto-cement board, gypsum wallboard, fiber board, plastic plate, are described. (*In Japanese.*) ***Sho Kimura.*** *Tokyo University, Institute of Industrial Science, Reports*, v. 10, no. 5, Jan. 1961, 48 pp.

* **Save Cooling Dollars With Multipackage System.** Shows that multiunit air conditioning is effective and economical in a one-story building. ***C. R. Havighorst.*** *Power*, v. 105, Apr. 1961, p. 66-68.

* **How Safe Is Your Industrial Ventilation?** Installation and application details on exhaust systems, make-air systems, industrial heating systems are considered in the light of Ford Motor Company standards. ***E. M. Schmidt.*** *Air Engineering*, v. 3, no. 4, Apr. 1961, p. 24-28.

Controlling External Noises for Recording Studios. Quite recently, oil wells have been drilled on studio properties, creating new noise and vibration problems. These, as well as other noise and vibration problems involving freeways, airplanes, and electric power stations, are described. ***Donald P. Loye.*** *Society of Motion Picture and Television Engineers, Journal*, v. 70, Feb. 1961, p. 98-100.

* **Application of Pneumatic Controls to Air Conditioning.** Following a general discussion of pneumatic controls, their application to some high-velocity systems is explained. The flexibility features necessitated by modular principles of office constructions are considered. ***G. F. Brown.*** *Institution of Heating and Ventilating Engineers*, v. 28, Mar. 1961, p. 405-429.

* **Air-Conditioning System Gains.** Tabular data are presented to simplify the calculation of heat gains in air-conditioning systems due to fan and pump horsepower. ***Brian M. Roberts.*** *Institution of Heating and Ventilating Engineers*, v. 28, Mar. 1961, p. 430-432.

TEXTILES, FIBERS, LEATHER, AND PAPER

* **Crystallinity of Wood Cellulose Fibers Studied by X-Ray Methods.** Crystallinity may increase with age and varies seasonally in juvenile wood. The crystallinity of reaction wood was different from that of normal wood. Crystallinity also increased during incipient decay. ***C. L. Lee.*** *Forest Products Journal*, v. 11, Feb. 1961, p. 108-112.

* **Progress in Wood Preservation, 1959-60.** ***H. E. Troxell.*** *Forest Products Journal*, v. 11, Feb. 1961, p. 67-76.

* **Progress in Wood Drying—1960.** ***Eric L. Ellwood.*** *Forest Products Journal*, v. 11, Feb. 1961, p. 55-66.

* **Aging of Alkali Cellulose at High Temperature.** The yield of cellulose decreases only slightly when the temperature of aging increases from 25 to 80 C. The decrease is explained by a reaction of the same type as during hot alkali treatment. At constant DP no differences in carbonyl and carboxyl contents can be detected when alkali cellulose is aged at different temperatures. ***Uno Albertsson and Olof Samuelson.*** *Svensk Paperstidning*, v. 64, no. 3, Feb. 15, 1961, p. 86-88.

Review of Textile Progress, 1959. v. XI. 448 pp. 1960. Textile Book Publishers, Inc., New York. (TS1449 R32 Vis.)

* **Cotton Quality Study VI. Wrinkle Resistance and Recovery From Deformation.** A comprehensive review of the literature together with an exposition of further research opportunities. Bibliography of 820 references. ***Henry Tovey.*** *Textile Research Journal*, v. 31, Mar. 1961, p. 185-252.

* **Revolutionary Trends in Pulp and Paper Manufacture.** ***Lincoln R. Thiesmeyer.*** *Pulp and Paper Magazine of Canada*, v. 62 ,Mar. 1961, p. 61-64.

WELDING AND JOINING

Engineers Come to Grips With Weld Distortion. *Iron Age*, v. 187, no. 8, Feb. 23, 1961, p. 104-106.

Friction Welding of Metals. II-III. Technology for special cases of equipment for friction welding. Present-day industrial setups and economics involved. ***Vadim Ivanovich Vill'.*** *Henry Brutcher Translation No.* 4919, 36 and 28 pp. (From *Svarka Metallov Treniem*, 1959, p. 36-60; p. 60-86.) Henry Brutcher, Altadena, Calif.

a **Some Metallurgical Aspects of CO_2-Shielded-Arc Welding.** Sound welds with good mechanical properties can be deposited in a variety of steels such as plain carbon, austenitic stainless, heat-resistant and low-alloy, high-strength steels. Welds are reported to have high resistance to both hot and cold cracking. The process is adaptable to the joining of plates ¼ to 6 or 7 in. thick, with high deposition rates, good weld appearance and low-inclusion count. ***M. D. Randall, P. J. Rieppel, S. L. Hoyt, and A. F. Chouinard.*** *Welding Journal*, v. 40, Apr. 1961, p. 169s-174s.

b **Notched Longitudinal-Bend Specimens for Evaluating Armour Weldments.** A longitudinal-bend specimen was used to evaluate the toughness performance of high-strength armor steel weldments prepared with austenitic and ferritic Grades 180 and 230 coated electrodes. The data from the bend specimens were compared with test results of H-plates made with the same lot of base plate and with similar electrodes. This work demonstrated that the modified longitudinal-bend specimen may be used as a partial substitute for the more costly H-plate test for evaluating the toughness performance of weldments in high-strength armor steel. ***S. M. Silverstein, R. P. Sopher, and P. J. Rieppel.*** *Welding Journal*, v. 40, Mar. 1961, p. 113s-117s.

c * **Conditions for the Occurrence of Pores During the Welding of Aluminum and Its Alloys.** For the formation of pores in the seams, the metal has to contain more than 0.69 cm^3/100 g of H. Partial degassing of the weld bath by flotation of bubbles formed with high H concentration is possible. (*In Russian.*) Usloviia vozniknoveniia por pri svarke aliuminiia i ego splavov. ***G. D. Nikiforov and A. G. Makhortova.*** *Svorachnoe Proizvodstvo*, 1961, no. 3, Mar., p. 5-8.

d **Reactive Diluents for Epoxy Adhesives.** Diluents containing epoxy groups can be used to control the viscosity of paste adhesives with minimum effect on high temperature bond strength. ***C. A. May and A. C. Nixon.*** *Industrial and Engineering Chemistry*, v. 53, Apr. 1961, p. 303-304.

e **Joining Refractory Metals Is Tricky Business.** Joining of the refractory metals and beryllium is considerably more difficult than the common materials of construction. Special considerations in the welding and brazing of these metals include: transition temperature; reactivity with impurities; recrystallization of parent material; porosity in welds; and intermetallic formation and thermal expansion differences in brazing. By controlling or minimizing the effects of these factors, complicated structures can be fabricated for a large variety of applications. ***G. M. Slaughter.*** *SAE Journal*, v. 69, May 1961, p. 52-55.

f **Ultrasonic Welding.** Welding by ultrasonic vibrations without the use of external heat is a comparatively new technique. Preliminary investigations have been carried out first with a rig applying axial pressure between the centers of two rotating discs, secondly with a rig using a vibrating reed principle, and thirdly with a modified ultrasonic cleaning set using piezoelectric barium titanate crystal blocks. The development of these rigs and the results of the tests are described and although it is concluded that none of these methods could achieve the results obtainable by using the more conventional nickel magnetostrictive transducers, a considerable amount of knowledge has been consolidated and added to the general understanding of the subject. A chronological survey of the literature dealing with ultrasonic welding is included. ***S. W. Nerille.*** *British Welding Journal*, v. 8, Apr. 1961, p. 177-187.

g **Influence of Storage Time on Weld Metal Ductility.** Tests were carried out on all-weld-metal specimens to determine how the storage time of the test bars influenced the ductility of the weld metal. The results showed that if the bars were stored long enough to avoid fish-eye formation the mechanical properties were approximately the same as those for degassed specimens. The tendency to fish-eye formation was influenced by the hydrogen content of the weld metal and also by the type of electrode. ***Claes Pfeiffer.*** *British Welding Journal*, v. 8, Apr. 1961, p. 172-175.

h **Some Recent Developments in Brazing.** The development of brazing techniques over the past 30 years is briefly described, and it is shown that brazing is now able to assist designers and

production engineers in many complex applications not suited to other methods of fabrication. Examples are given of successful applications to materials with high alloy content for which nickel-base brazing alloys are most suitable. Consideration is also given to the choice of fluxes, and attention is drawn to the need for careful design appropriate to the technique and the maintenance of correct joint clearances. ***G. R. Bell.*** *British Welding Journal,* v. 8, Apr. 1961, p. 166-171.

Mild Steel Welding With Argon/CO_2 Mixtures. Investigations into the performance of mixtures of argon and CO_2 for the bare wire gas-shielded welding of mild steel show that these mixtures, in the range containing 20-25% CO_2, have features not possessed effectively by either argon/O_2 or CO_2. Weld bead shape is better than with either of the constituent gases. For welding with the metal being transferred under free flight conditions, a spray type of transfer can be obtained, and in dip-transfer welding stable conditions can be obtained at voltages 2-3 V lower than with CO_2. These features lead to economic advantages over the use of CO_2 for welding sheet metal and to operational advantages for welding plate ¾ in. thick and over. ***B. H. Baker, N. Crevis, J. A. Lucey, and F. W. Lunau.*** *British Welding Journal,* v. 8, Apr. 1961, p. 151-161.

Automatic Tungsten-Arc Welding of Heat Exchangers (Especially Feedwater Heaters). The development of satisfactory welding procedures for the welding of power-station feedwater heaters is described. Some early experiences with manual tungsten-arc welding are mentioned together with subsequent work on automatic welding guns. The processes described are well suited to the making of precision joints in tubular heat exchangers, and inspection methods are noted which should ensure reliability of plant in service. ***N. T. Burgess.*** *British Welding Journal,* v. 8, Apr. 1961, p. 141-150.

Mild Steel Electrodes for Contact Welding. Discusses design and properties. Comparisons are made between noncontact and various designs of contact electrodes in respect to electrode and welding costs. Examples are given of applications and reductions in welding costs achieved with a contact metal-powder electrode. ***J. W. Addie.*** *British Welding Journal,* v. 8, Apr. 1961, p. 135-140.

Foil Seam Welding. In contrast to the normal lap-seam resistance welding process, foil seam welding enables butt joints to be made successfully in sheet metal panels. The principles of the process are described, including the means of concentrating the welding heat at the zone of the joint and of applying the correct pressure for welding. The results of practical experience are given, together with guidance on the suitable methods of sheet preparation, choice of foil, and selection of welding machine variables. Special welding machines are described and examples are quoted of the advantages of the process when applied to certain types of fabricated construction. ***F. Busse.*** *British Welding Journal,* v. 8, Apr. 1961, p. 123-129.

Developments in Stud Welding. Deals with stud welded shear connectors and developments in aluminum alloy stud welding. ***D. J. N. Laurie.*** *British Welding Journal,* v. 8, Apr. 1961, p. 113-121.

Automatic Arc Welding Equipment. Describes equipment and operating procedures for continuous covered electrode, submerged-arc, and flux and gas shielded processes. ***C. W. J. Vernon.*** *Welding and Metal Fabrication,* v. 29, Apr. 1961, p. 141-148.

* **Static Strength of Spot-Welded Joints at Normal and Low Temperatures.** Joints obtained by contact welding can be used successfully in light lattice structures of low carbon-steel up to 8 mm in thickness. Such lattice structures can be used at temperatures down to −55 C. (*In Russian.*) Staticheskaia prochnost' tochechnykh svarnykh soedinenīĭ pri normal'noi i nizkoĭ temperaturakh. ***G. V. Zhemchuzhnikov and R. G. Romanovskiĭ.*** *Avtomaticheskaia Svarka,* v. 14, no. 4(97), Apr. 1961, p. 54-60.

* **Welding With Consumable Electrode of AMg6 Alloy in Argon With Chlorine Addition.** When introducing Cl into the composition of the protective atmosphere during the welding of Al-Mg alloys with a consumable electrode, porosity is prevented and the strength of the metal seam is somewhat increased. The optimum Cl amount is 1-2%. This type of welding must be carried out in systems provided with exhaust ventilation. (*In Russian.*) Svarka plaviashchimsia elektrodom splava AMg6 v argone s primes'iu khlora. ***D. M. Rabkin and B. A. Steblovskiĭ.*** *Avtomaticheskaia Svarka,* v. 14, no. 4(97), Apr. 1961, p. 78-82.

MISCELLANEOUS

* **The Holonomy Group V. Weyl Space W_n. I.** ***Václav Hlavatý.*** *Journal of Mathematics and Mechanics,* v. 10, no. 2, Mar. 1961, p. 317-348.

* **Lower Bounds for Eigenvalues.** Develops a method for finding lower bounds to the eigenvalues of semi-bounded self-adjoint operators. ***Norman W. Bazley.*** *Journal of Mathematics and Mechanics,* v. 10, no. 2, Mar. 1961, p. 289-307.

* **Singular Integral Equations, Boundary Value Problems and the Riemann-Roch Theorem.** ***Walter Koppelman.*** *Journal of Mathematics and Mechanics,* v. 10, no. 2, Mar. 1961, p. 247-277.

* **The Engineer and Architect—As Defendant.** The courts, through the power of judicial decision, are defining, redefining and enlarging the scope and area of obligation of the professional man with respect to his acts and their impact on third persons. In part this has been brought about by a change in social thinking and in part by present-day needs. ***Robert B. Jarvis and M. Asce.*** *Civil Engineering,* v. 31, Mar. 1961, p. 33-35.

* **Critique of Oberg's "Age and Achievement—and the Technical Man".** The author cites evidence to show that older research personnel are an asset, not a liability. ***Wayne K. Kirchner.*** *Personnel Psychology,* v. 14, no. 1, Spring 1961, p. 53-58.

* **Music on the Job: Its Influence on Worker Morale and Production.** The author has made an extensive survey of the use of music in industry. There is an extensive bibliography. ***Richard S. Uhrbrock.*** *Personnel Psychology,* v. 14, no. 1, Spring 1961, p. 9-38.

* **On Certain Determinants Whose Elements Are Orthogonal Polynomials.** The present investigation was inspired by Turán's inequality and by probability considerations. Certain determinants are studied whose elements are orthogonal polynomials. In some cases the polynomials represented by these determinants will keep a constant sign; in some other cases they will prove to be oscillatory. ***S. Karlin and G. Szegö.*** *Journal d'Analyse Mathématique,* v. 8, 1960-1961, p. 1-157.

* **On Matching Lists by Samples.** The problem considered is estimation by sampling methods of the number of names common to two or more lists. The situation covered is that in which the lists are found to have been merged and must be sampled as one. ***Des Raj.*** *American Statistical Association, Journal,* v. 56, no. 293, Mar. 1961, p. 151-155.

* **A Parametric Estimate of the Standard Error of the Survival Rate.** Proposes a simplification of Greenwood's estimate of the standard error of the survival rate. The simplifying assumptions are that cases enter the follow-up study at a uniform rate, there are no losses to follow-up, and the mortality risk for successive follow-up intervals is constant. Numerical examples drawn from cancer registry data indicate that the proposed estimate yields acceptable results under certain realistic circumstances despite some marked deviations from the simplifying assumptions. ***Fred Ederer.*** *American Statistical Association, Journal,* v. 56, no. 293, Mar. 1961, p. 111-118.

* **Unbiased Ratio Estimators in Stratified Sampling.** ***Jose Nieto de Pascual.*** *American Statistical Association, Journal,* v. 56, no. 293, Mar. 1961, p. 70-87.

* **Almost Linearly-Optimum Combination of Unbiased Estimates.** A procedure for combining averages, each estimating the same parameter, is proposed. ***Max Halperin.*** *American Statistical Association, Journal,* v. 56, no. 293, Mar. 1961, p. 36-43.

* **Some Aspects of Seasonality in the Consumer Price Index.** The Consumer Price Index of the Bureau of Labor Statistics is subject to a variety of seasonal influences, some of which are

related to supply and some to demand factors. Recent calculations reveal that there is little seasonality in the index as a whole, although some items show seasonal price movements of considerable magnitude. Widespread use of the CPI for wage escalation emphasizes the need for consideration of the problem. ***H. E. Riley.*** *American Statistical Association, Journal,* v. 56, no. 293, Mar. 1961, p. 27-35.

* **Developing Professionalism Among Engineers in Industry.** The Phillips Petroleum Company was selected to receive NSPE's first annual Industrial Professional Development Award as the organization which has shown outstanding achievement in adopting and implementing progressive, professional employment policies for its engineering personnel. ***George F. Downs, Jr.*** *American Engineer,* v. 31, Mar. 1961, p. 38 + 4 pages.

* **Mathematical Handbook for Scientists and Engineers. Definitions, Theorems, and Formulas for Reference and Review.** Intended as a comprehensive reference collection of mathematical definitions, theorems, and formulas for scientists, engineers, and students, this handbook also attempts to present a connected survey of mathematical methods useful beyond specialized applications. Each chapter is arranged so as to permit rapid review of an entire mathematical subject. Such a presentation is made more manageable and readable through the omission of proofs; numerous references provide access to textbook material for more detailed studies. ***Granino A. Korn and Theresa M. Korn.*** 943 pp. 1961. McGraw-Hill, New York. (QA40 K84m Ref.)

Mathematics, Computers, Operations Research, and Statistics. Reviews publications of the past year of interest to the chemical engineer in the fields given in the title. Contains an extensive bibliography. ***Robert F. Sweeny, et al.*** *Industrial and Engineering Chemistry,* v. 53, Apr. 1961, p. 329-336.

The Role of Technical Societies. The primary task of technical societies is to advance and disseminate scientific and technical knowledge. There are no other agencies open to such world-wide sources where technical information can be gathered as promptly and completely as through such society functions as meetings, seminars, conferences, technical discussions, and current technical publications. The larger societies must constantly re-evaluate the services they offer, keeping in mind that they must remain at least abreast, and preferably ahead, of the tide of technological change. Instead of a great number of societies struggling to keep alive, we should have a strongly coordinated group made up of large and well-established technical societies that are capable of performing the normal as well as the specialized tasks they are called upon to do. ***C. H. Lorig.*** *Materials Research & Standards,* v. 1, Mar. 1961, p. 201-202.

Unique Propellant Hazards Demand Unique Handling Methods. Surveys some of the more important areas associated with propellant handling: training techniques, medical aspects, and contamination control. The handling of liquid and gaseous hydrogen, and handling techniques utilized in testing liquid and solid rockets also are discussed. ***D. H. Wayman.*** *SAE Journal,* v. 69, Apr. 1961, p. 86-88.

Industrial Research in Cleveland—Northeast Ohio. This study attempts to answer these questions. How does Cleveland stand in number of research workers with other major cities in the U.S.? What is the extent of research activities in Cleveland–Northeast Ohio with respect to number of firms maintaining laboratories, number of employees engaged in research and development, and the cost of research in average yearly wages? What location factors are significant in choosing a site for a research center? 27 pp. 1958. Cleveland Electric Illuminating Co., Cleveland, Ohio. (T13 R31o Over.)

* **The Importance of Goals.** The chairman of the Eisenhower Commission on National Goals proposes a "parallel interest" approach to easing East-West tensions, relates the Latin American situation to Cuban specifics, and stresses the key role of business in foreign relations. ***Henry M. Wriston.*** *General Electric Defense Quarterly,* v. 4, no. 1, Jan.-Mar. 1961, p. 12-16.

* **Priorities for Peace.** Defines the immediate and imperative, the middle range and necessary, and the long range and desirable priorities the United States must establish for national survival. ***Frank R. Barnett.*** *General Electric Defense Quarterly,* v. 4, no. 1, Jan.-Mar. 1961, p. 17-21.

Hazardous Substances Labeling. What manufacturers should know about labeling household chemical specialties for safe use. ***E. G. Klarmann.*** *Soap and Chemical Specialties,* v. 37, Feb. 1961, p. 55 + 3 pages.

Experiments With Materials and Products of Industry. Experiments in auto mechanics, ceramics, electricity, finishing materials, fasteners, leather, metalwork, photography, plastics, and textiles are outlined in this new method of teaching. Perhaps of greatest value are the 14 points on getting the most out of experiments which include literature search, limits, and presentations, problem and equipment design, and report preparation. ***Arthur W. Earl.*** 351 pp. 1960. McKnight & McKnight Publishing Co., Bloomington, Ill. (TA410 Ea73e)

Races of Mankind, Their Origin and Migration. Apparently for the first time in history, all ancient tribes and nations of mankind are shown to be connected filially, and their routes of migration are traced from primitive regions to present habitations, notably in western Asia and Europe. Also explains the causes of racial differences. ***Calvin Kephart.*** 566 pp. 1960. Philosophical Library, New York. (GN315 K44r)

Space Research. Proceedings of the First International Space Science Symposium. The earth's atmosphere, the ionosphere, tracking and telemetering, solar radiation, cosmic radiation, interplanetary dust, the moon and the planets are discussed. ***Hilde Kallmann Bijl, editor.*** 1195 pp. 1960. Interscience Publishers, New York. (TL787 In8.7s)

Electronic Traffic Control. Philosophy of guided evolution is needed to make traffic aids now being developed compatible with those of the future. Proposed electronic control system that embodies this concept is outlined. ***Edward K. Damon and Robert L. Cosgriff.*** *Electronics,* v. 34, no. 1, Jan. 6, 1961, p. 109-114.

Study on People Power. A collection of six articles stressing the necessity of getting top quality work from employees, with special emphasis on the metalworking industries. *Steel,* v. 149, Jan. 2, 1961, p. 89 + 39 pages.

* **Selected Bibliography of Statistical Literature, 1930 to 1957. IV. Markov Chains and Stochastic Processes.** Carries over 1,000 references published since 1930. ***Lola S. Deming and D. Gupta.*** *U. S. National Bureau of Standards, Journal of Research, Section B, Mathematics and Mathematical Physics,* v. 65B, no. 1, Jan.-Mar. 1961, p. 61-93.

* **Index to the Distributions of Mathematical Statistics.** A fairly complete index of references to results on statistical distributions published before Jan. 1958 is presented. The material given for each distribution is a list of references relating to: functions and constants which characterize the distribution, derived distributions, estimation, testing statistical hypotheses, and miscellaneous. The number of entries varies from one or two for less well-known distributions to several hundred for the normal distribution. This index should serve to eliminate unnecessary derivation of results already in the literature. ***Frank A. Haight.*** *U. S. National Bureau of Standards, Journal of Research, Section B, Mathematics and Mathematical Physics,* v. 65B, no. 1, Jan.-Mar. 1961, p. 23-60.

* **Computational Problems Concerning the Hilbert Matrix.** The interaction between theoretical mathematics and practical computational experiment is illustrated by a discussion of recent work, at various centers, concerning the Hilbert matrix. ***John Todd.*** *U. S. National Bureau of Standards, Journal of Research, Section B, Mathematics and Mathematical Physics,* v. 65B, no. 1, Jan.-Mar. 1961, p. 19-22.

* **Physico-Chemical and Medical Considerations Concerning the Dangers and Damages Caused by Radiation in the Iron and Steel Industry.** The use of radiant energy in industry brings hazards which must be carefully controlled. (In German.) Physikalisch-chemische und medizinische Betrachtungen über die Gefahr auftretender Strahlenschäden in der Eisen- und Stahlindustrie. ***A. Krausz and F. Wechselberger.*** *Radex Rundschau,* 1961, no. 1, Feb., p. 492-505.

Polynomials Orthogonal on a Circle and Interval. Establishes the proof of the asymptotic formulae under more general conditions than determined by previous authors, and thereafter finds the conditions under which a system of orthogonal polynomials is limited on the entire interval of

orthogonality or on a part of it. Deals also with the problem—which is of direct importance in the study of infinite processes linked with orthogonal polynomials—of finding the order of the growth of these polynomials as a function of their number, without assuming their limits. ***Ya. L. Geronimus.*** 210 pp. 1960. Pergamon Press, New York. (QA404.5 G31mtr)

Scientists and American Science Policy. Who speaks for science? The future offers more dilemmas than unequivocal answers in science policy. ***Wallace S. Sayre.*** *Science*, v. 133, Mar. 24, 1961, p. 859-864.

* **Men, Machines, and Models.** Models are flourishing as never before in psychology. The author discusses the merits and pitfalls to be found in their use. ***Alphonse Chapanis.*** *American Psychologist*, v. 16, Mar. 1961, p. 113-131.

* **The Epsilon Algorithm and Operational Formulas of Numerical Analysis.** Describes a nonlinear technique which appears to have powerful and general application in numerical analysis. ***P. Wynn.*** *Mathematics of Computation*, v. 15, no. 74, Apr. 1961, p. 151-158.

* **On the Numerical Solution of Convolution Integral Equations and Systems of Such Equations.** Discusses the application of a simple quadrature formula to the numerical solution of convolution integral equations of Volterra type and to systems of simultaneous equations of the same type. ***J. G. Jones.*** *Mathematics of Computation*, v. 15, no. 74, Apr. 1961, p. 131-142.

* **Table of a Weierstrass Continuous Non-Differentiable Function.** Many studies have been made of continuous non-differentiable functions, the most famous of which is Weierstrass's $W(a,b,x)$. Owing to the unusual nature of $W(a,b,x)$ and the absence of any previous table, or even graph, despite the countless number of theoretical papers, the author presents an extensive table of this Weierstrass function for some typical pair of parameters a and b. ***Herbert E. Salzer and Norman Levine.*** *Mathematics of Computation*, v. 15, no. 74, Apr. 1961, p. 120-130.

* **Forecasting Travel Patterns.** Gives results of a survey made for the U. S. Bureau of Public Roads of the traffic demands anticipated by 1975 in the general region of Ogden, Utah so that the Bureau could properly locate portions of the Federal Aid interstate routes through that region. ***Justin F. Farmer.*** *Traffic Engineering*, v. 31, no. 7, Apr. 1961, p. 24-28.

* **An Urban Area Accepts the Street Challenge—The Phoenix Program.** The adopted major street and highway plan is designed to serve a horizon year population for the Phoenix Urban Area of 1.4 million people. ***Edward M. Hall.*** *Traffic Engineering*, v. 31, no. 7, Apr. 1961, p. 11 + 4 pages.

* **Test of Stimulus Sampling Theory for a Continuum of Responses With Unimodal Noncontingent Determinate Reinforcement.** Tests a formulation of stimulus sampling theory for a continuum of responses when reinforcement is determinate and the probability distribution of reinforcements is non-contingent, unimodal, and symmetric. ***Patrick Suppes and Raymond W. Frankmann.*** *Journal of Experimental Psychology*, v. 61, no. 2, Feb. 1961, p. 122-132.

* **Extra-Experimental Interference and the Retention of Words.** Reports three studies designed to explore the sources of extra-experimental interference in the forgetting of meaningful materials. ***Leo Postman.*** *Journal of Experimental Psychology*, v. 61, no. 2, Feb. 1961, p. 97-110.

EJC 1960 Study Reveals Engineers' Salaries Continue to Rise. Summarizes data from fourth survey conducted for Engineers Joint Council. *Mechanical Engineering*, v. 83, Apr. 1961, p. 113.

High School Backgrounds of Science Doctorates. A survey reveals the influence of class size and region of origin, as well as ability, in Ph.D. production. ***Lindsey R. Harmon.*** *Science*, v. 133, Mar. 10, 1961, p. 679-688.

Federal Patent Policy to Get Another Airing. New proposals on patent rights of government R&D contractors raise an old issue once more. *Chemical & Engineering News*, v. 39, no. 11, Mar. 13, 1961, p. 36-39.

What ACS Members Think About Professional Status. A comprehensive survey of member opinion was conducted by an independent agency in 1960. The information obtained will be applied in a professional relations program designed, within the framework of the Society's National Charter as a scientific and educational association, to meet the members' needs and desires. *Chemical & Engineering News*, v. 39, no. 11, Mar. 13, 1961, p. 78-83.

Papers Delivered at the Water Rights Conference, Held at The Kellogg Center, Michigan State University, East Lansing, Michigan. The Mar. 1960, Water Rights Conference at East Lansing was planned and carried out by the College of Agriculture Water Resources Committee which carries on such study, with particular reference to the use, development, management and conservation of Michigan's water resources. 77 pp. Mar. 29, 1960. Michigan State University, East Lansing, Mich. (HD1694.A5 W29p Over.)

* **The Aswan High Dam.** The creation of a great reservoir of Nile water in Nubia land and of a 2,100-megawatt hydroelectric station calls for ten years' construction work on a gargantuan scale. The greatest difficulty is that the dam must be built on the floor of the existing Aswan reservoir. ***Hassan Zaky.*** *New Scientist*, v. 9, Mar. 9, 1961, p. 600-602.

The Fourth Dimension in Science Education. Discusses the means by which science teachers can interest students in becoming general physicists rather than specialists. ***Ladis D. Kovach.*** *Physics Today*, v. 14, Mar. 1961, p. 48-50.

* **Statistical Methods in Markov Chains.** An expository survey of the mathematical aspects of statistical inference as it applies to finite Markov chains, the problem being to draw inferences about the transition probabilities from one long, unbroken observation $\{x_1, x_2, \ldots, x_n\}$ on the chain. The topics covered include Whittle's formula, chi-square and maximum-likelihood methods, estimation of parameters, and multiple Markov chains. At the end of the paper it is briefly indicated how these methods can be applied to a process with an arbitrary state space or a continuous time parameter. ***Patrick Billingsley.*** *Annals of Mathematical Statistics*, v. 32, no. 1, Mar. 1961, p. 12-40.

* **A Unified Theory of Estimation. I.** Extends and unifies some previous formulations and theories of estimation for one-parameter problems. The basic criterion used is admissibility of a point estimator, defined with reference to its full distribution rather than special loss functions such as squared error. Theoretical methods of characterizing admissible estimators are given, and practical computational methods for their use are illustrated. ***Allan Birnbaum.*** *Annals of Mathematical Statistics*, v. 32, no. 1, Mar. 1961, p. 112-135.

The College-Student Image of the Scientist. Scientists are seen as intelligent and hard-working but also as uncultured and not interested in people, according to a survey recently completed. ***David C. Beardslee and Donald D. O'Dowd.*** *Science*, v. 133, Mar. 31, 1961, p. 997-1001.

* **On Global Solutions for Partial Differential Equations of First Order.** States a theorem which guarantees the existence and uniqueness of a global solution for the Cauchy initial value problem for a complete, regular system of partial differential equations of first order for one unknown function on a manifold—all data being of class C^*. ***Peter Dombrowski.*** *American Mathematical Society, Bulletin*, v. 67, no. 2, Mar. 1961, p. 202-205.

Contract Maintenance—How Far to Go? Three refinery maintenance men give their views on outside contracting. One advocates complete contracting of maintenance and plant engineering—the others see it as a valuable supplement to regular in-plant maintenance forces. ***R. B. Beattie and W. W. Harris.*** *Chemical Engineering*, v. 68, Apr. 3, 1961, p. 170 + 3 pages.

Bibliography of High-Temperature Condensed States Research in Canada and Elsewhere, July to September, 1960. Covers devices for achieving, measuring, and controlling high temperatures; devices for physical measurements at high temperatures; properties and uses of materials at various temperatures; phase equilibria; and reactions at high temperatures. ***Norman F. H. Bright.*** *Canada, Mines Branch, Information Circular, IC* 122, Nov. 1960, 69 pp. (TN26 C16.5i Contin.)

Scientist and Public. Why is the scientist, once a "natural philosopher", now considered a barbarian by many educated laymen? ***René Dubos.*** *Science,* v. 133, Apr. 21, 1961, p. 1207-1211.

Confidence Interval Inference and Sample Size Determination. ***Richard B. McHugh.*** *American Statistician,* v. 15, no. 2, Apr. 1961, p. 14-17.

* **On a Class of Unimodal Distributions.** Establishes the unimodality of a class of distribution functions which were studied by Linnik. ***R. G. Laha.*** *American Mathematical Society, Proceedings,* v. 12, no. 2, Apr. 1961, p. 181-184.

* **An Analytic Method for the "Difficult Crossing" Puzzles.** A family of well-known recreational mathematical problems is attacked by a novel method, involving the use of linear graph theory. ***Benjamin L. Schwartz.*** *Mathematics Magazine,* v. 34, no. 4, Mar.-Apr. 1961, p. 187-193.

* **On the Interval Topology of An *l*-Group.** Considers the well-known interval topology of *G,* which is obtained by taking the family of all-closed intervals of *G* as a sub-base for the closed sets. Shows that the behavior of a certain *l*-group is far from "pathological," but actually is characteristic of large classes of *l*-groups. ***E. S. Wolk.*** *American Mathematical Society, Proceedings,* v. 12, no. 2, Apr. 1961, p. 304-307.

* **The Construction of Unidimensional Tests.** Five methods of constructing unidimensional tests (classical item analysis, Loevinger's procedure, the independence criterion method, the answer pattern method, and factor analysis) have been considered with respect to their provision for: a rational procedure for item selection, a criterion of unidimensionality, and an index of unidimensionality. ***James Lumsden.*** *Psychological Bulletin,* v. 58, no. 2, Mar. 1961, p. 122-131.

Experiments With Materials and Products of Industry. Experiments in auto mechanics, ceramics, electricity, finishing materials, fasteners, leather, metalwork, photography, plastics, and textiles are outlined in this new method of teaching. Perhaps of greatest value are the 14 points on getting the most out of experiments which include literature search, limits, and presentations, problem and equipment design, and report preparation. ***Arthur W. Earl.*** 351 pp. 1960. McKnight & McKnight Publishing Co., Bloomington, Ill. (TA410 Ea73e)

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"A Forward Strategy for America." A Book Analysis. The free world, declare three distinguished authors, Dr. Robert Straus-Hupé, Col. William R. Kintner, and Dr. Stefan Possony, has "steadily lost ground in the international struggle with communism". The answer, they say, is an across-the-board "strategy of active pressures against the Communist bloc". *Air Force,* v. 44, May 1961, p. 34 + 2 pages.

The Necessity for Choice. Prospects of American Foreign Policy. Attempts to define the major foreign policy and defense issues before America in the 1960's. Underlying the work is a sense of urgency, based on the author's conviction that in this revolutionary age the norm is the fact of upheaval, and solutions, however comprehensive they seem, can never be regarded as permanent. Therefore, as a nation, we must overcome our obsession with safety and predictability, which produces an attitude fearful of risk, and muster dedication and creativity before the worst has happened. ***Henry A. Kissinger.*** 370 pp. 1961. Harper & Brothers, Publishers, New York. (UA23 K64nc)

The Strategy of Conflict. The precarious strategy of cold war and nuclear stalemate has often been expressed in game analogies. Mr. Schelling, without excessive use of mathematics or esoteric apparatus, explores the strategy of threats and promises—of coercion, deterrence, and cooperation. He develops the theory of coordination as an integral part of the theory of games, with experimental results that the reader can duplicate for himself. He analyzes the strategic role of deliberately leaving something to "chance" in brinkmanship, limited war, and the threat of accidental war. He illuminates the paradox that, in bargaining, strength often inheres in weakness, that rationality is not necessarily an asset. ***Thomas C. Schelling.*** 309 pp. 1960. Harvard University Press, Cambridge, Mass. (BF637.N4 Sch26s)

Our National Park Policy. A Critical History. This is a skillful narrative of the political and administrative struggles that through the years have created the system we enjoy today. In addition, it is a thoughtful analysis of the problems that still beset the parks—chief among them the problem of finance. ***John Ise.*** 701 pp. 1961. Johns Hopkins Press, Baltimore, Md. (SB482 Is2o)

* **Systems-Disconjugacy of a Fourth-Order Differential Equation.** There has been a recent renewal of interest in the oscillatory behavior of solutions of linear self-adjoint differential equations of the fourth order. This paper is primarily concerned with the fourth-order equation (1) where $r(x)$ and $p(x)$ are both positive and continuous on $[a, \infty]$ and the designation "(1)" will denote the equation (1), together with these restrictions on the coefficients except in one or two cases in which departure from this convention will be explicitly given. ***John H. Barrett.*** *American Mathematical Society, Proceedings,* v. 12, no. 2, Apr. 1961, p. 205-213.

* **Solution of a Difference Equation Pertinent to Linear Parametric Electric Networks.** Presents an algorithm for finding the fundamental system of solutions of a class of linear difference equations relative to a theorem of Perron. This particular fundamental system is important in the analysis of physical systems with periodic parameters such as linear parametric networks and parametric amplifiers. ***B. J. Leon.*** *Quarterly of Applied Mathematics,* v. 19, no. 1, Apr. 1961, p. 63-68.

Human Behavior During the Tsunami of May 1960. Research on the Hawaiian tidal-wave disaster explores the consequences of an ambiguous warning system. ***Roy Lachman, Maurice Tatsuoka, and William J. Bonk.*** *Science,* v. 133, May 5, 1961, p. 1405-1409.

* **The National Security Dilemma: Challenge to Management Scientists.** The same rigorous analysis of interaction, weighing of probabilities, and testing of alternative courses of action against both objectives and contingencies, which characterize management science in more easily delimited problems, should be extended to this great issue of national policy. ***Marshall K. Wood.*** *Management Science,* v. 7, no. 3, Apr. 1961, p. 195-209.

* **The Question of Establishing a National Academy of Engineering.** The proper solution to the question of establishing a National Academy of Engineering is important to the nation, the engineering profession, and ASEE. This article is published to stimulate discussion and assist in gathering a consensus. ***Harold K. Work.*** *Journal of Engineering Education,* v. 51, no. 9, May 1961, p. 698-700.

* **Science in the Sixties.** This is the 1960 Proctor Prize Award address by the head of the National Science Foundation. ***Alan T. Waterman.*** *American Scientist,* v. 49, no. 1, Mar. 1961, p. 1-8.